Fast Charger For Nicad Batteries

SILICON CHIP

N W27 5 9
C11 $4.95

$4.95 OCTOBER 1995
NZ $5.95 INCL GST

AUSTRALIA'S DYNAMIC ELECTRONICS MAGAZINE

ERVICING - VINTAGE RADIO - COMPUTERS - BUILD

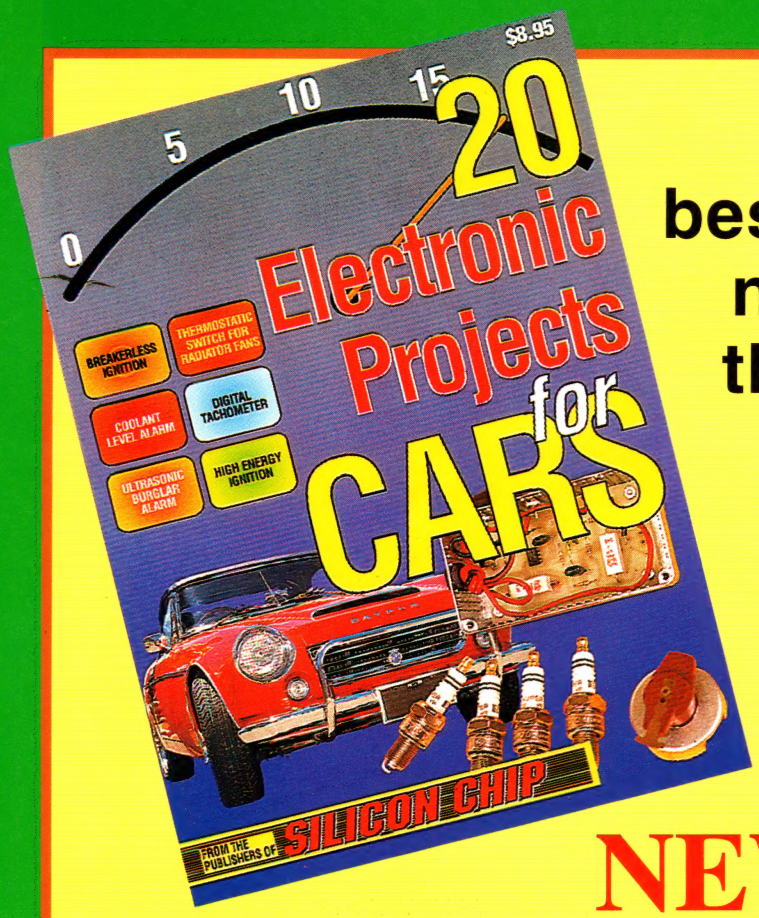
Monitor radioactivity with this compact

Geiger Counter

Digital Speedo & Fuel Gauge

Build Your Own Hifi Loudspeakers

ISSN 1030-2662
10
9 771030 266001
PRINT POST APPROVED - PP255003/01272



SILICON CHIP'S 20 best car projects are now all together in this 112-page book

ON SALE NOW AT SELECTED NEWSAGENTS

This book has 20 electronic projects for cars, including high energy & breakerless ignition systems, an ultrasonic alarm, a digital tachometer, a coolant level alarm, a flashing alarm light, a talking headlight reminder, a UHF remote switch & a thermostatic switch for electrically operated radiator fans. And there are eight quick circuit ideas as well.

Price: $8.95 (plus $3 p&p if ordering from Silicon Chip)

Yes! Please send me ____ copies of **20 Electronic Projects For Cars**

Enclosed is my cheque/money order for $_____ or please debit my

❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | |

Signature_____ Card expiry date____/____

Name _____ Phone No (____)_____
PLEASE PRINT

Street _____

Suburb/town _____ Postcode_____

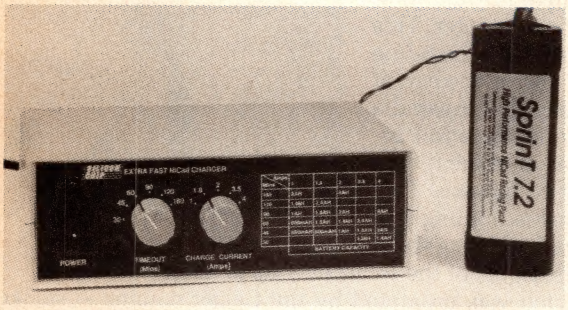
Or fill in & mail or fax this easy-order form

Order today by phoning (02) 9979 5644 & quoting your credit card number; or fill in the coupon & fax it to (02) 9979 6503; or mail the coupon to: Silicon Chip Publications, PO Box 139, Collaroy, NSW 2097.

SILICON CHIP

VOL.8, NO.10; OCTOBER 1995

Contents



FAST CHARGER FOR NICADS – PAGE 54

FEATURES

4 AUTOMOTIVE IGNITION TIMING; PT.2

A look at how programmable engine management ECUs are allowing specialist engine tuners to devise their own ignition maps – by Julian Edgar

66 COMPUTER BITS: CONNECTING TO THE INTERNET WITH WINDOWS 95

Microsoft's new Windows 95 makes it easy to connect to the Internet. Here's a quick look at what's involved – by Geoff Cohen

PROJECTS TO BUILD

16 BUILD A COMPACT GEIGER COUNTER

This easy-to-build device will detect alpha, beta and gamma radiation and generates an audible output. It's based on a Geiger Muller tube and is powered by a 9V battery – by John Clarke

22 A 3-WAY BASS REFLEX LOUDSPEAKER SYSTEM

New design uses high-quality Vifa drivers for high power handling and great sound – by Leo Simpson

32 RAILPOWER MKII: A WALK-AROUND THROTTLE FOR MODEL RAILWAYS; PT.2

The full construction details and the testing procedure, plus brief troubleshooting details – by Rick Walters

54 A FAST CHARGER FOR NICAD BATTERIES

Fast charges 5-10 cells at once from a 12V car battery and automatically reverts to trickle mode at the end of the charging cycle – by John Clarke

74 DIGITAL SPEEDOMETER & FUEL GAUGE FOR CARS

Update your car's dashboard to a fancy electronic display. Includes a 6-position overspeed alarm as well – by Jeff Monegal

COMPACT GEIGER COUNTER FOR RADIATION CHECKS – PAGE 16

BUILD A HIGH-POWER 3-WAY LOUDSPEAKER SYSTEM – PAGE 22

SPECIAL COLUMNS

40 SERVICEMAN'S LOG

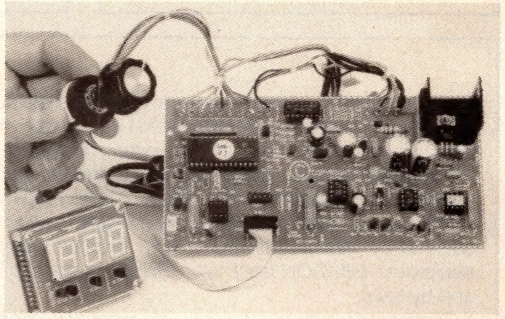
The view was fabulous, but ... – by the TV Serviceman

86 VINTAGE RADIO

Vibrators: a slice of history – by John Hill

DEPARTMENTS

2 PUBLISHER'S LETTER
10 CIRCUIT NOTEBOOK
31 ORDER FORM
82 PRODUCT SHOWCASE
92 ASK SILICON CHIP
94 MARKET CENTRE
96 ADVERTISING INDEX



DIGITAL SPEEDOMETER AND FUEL GAUGE FOR CARS – PAGE 74

Publisher & Editor-in-Chief
Leo Simpson, B.Bus.

Editor
Greg Swain, B.Sc.(Hons.)

Technical Staff
John Clarke, B.E.(Elec.)
Robert Flynn
Rick Walters

Reader Services
Ann Jenkinson

Advertising Enquiries
Leo Simpson
Phone (02) 9979 5644

Regular Contributors
Brendan Akhurst
Garry Cratt, VK2YBX
Marque Crozman, VK2ZLZ
Julian Edgar, Dip.T.(Sec.), B.Ed
John Hill
Jim Lawler, MTETIA
Philip Watson, MIREE, VK2ZPW
Jim Yalden, VK2YGY
Bob Young

Photography
Stuart Bryce

SILICON CHIP is published 12 times a year by Silicon Chip Publications Pty Ltd. A.C.N. 003 205 490. All material copyright ©. No part of this publication may be reproduced without the written consent of the publisher.

Printing: Macquarie Print, Dubbo, NSW.

Distribution: Network Distribution Company.

Subscription rates: $49 per year in Australia. For overseas rates, see the subscription page in this issue.

Editorial & advertising offices: Unit 34, 1-3 Jubilee Avenue, Warriewood, NSW 2102. Postal address: PO Box 139, Collaroy Beach, NSW 2097. Phone (02) 9979 5644. Fax (02) 9979 6503.

ISSN 1030-2662

PUBLISHER'S LETTER

Smoke detectors are not a health hazard

This month's topic is prompted by our publication in this issue of a Geiger counter. This itself was prompted by the French, scheduling nuclear tests in the Pacific. Now let me say, at the outset, that I don't believe that Australia will experience any increase in radiation because of these tests, either now or in the future. We are too far away for that to happen. That does not justify the tests though – nothing can. Australia is right to protest loud and long about the tests, if only to protect the rights of the small nations in the Pacific.

But to get to the topic which was prompted by the Geiger counter – smoke detectors. As part of the article on the Geiger counter we have suggested that readers can partly dismantle a smoke detector to expose the radioactive source within. No doubt there will be some readers who will be upset at this but what we are proposing is perfectly safe. Sure, if someone decides to be stupid and **eats** the minute amount of Americium 241, they will probably die in the fullness of time.

I am sure that the vast majority of readers would agree that smoke detectors present no hazard at all but would you believe that the NSW Environmental Protection Authority is really worried about them. Their scenario goes like this: now that governments have made it mandatory for all new houses to have smoke detectors installed, millions of these devices will eventually be thrown out and will end up in landfill and thereby constitute a future hazard. The EPA therefore wants all smoke detectors to be returned to the manufacturers when they are ultimately disposed of. Now a few moment's thought will show that this is yet another example of rampant bureaucracy.

Let's say that a million smoke detectors all ended up dumped in the same landfill in 20 years time. Americium 241 has a half-life of 400 years, so the alpha source will have barely deteriorated at all. So each smoke detector contains 0.9 microcuries and they constitute a total radioactive deposit of 0.9 curies and therefore could constitute a danger to the environment! Clearly, this is utter nonsense. The same landfill would also contain several million tonnes of other garbage and therefore the radioactivity of the whole dump would be no more than the rest of the landscape. The garbage would "dilute" the radioactivity. And any runoff from the landfill would no doubt contain far more lethal chemicals than Americium 241.

The very concept of returning smoke detectors to the manufacturers is crazy. These devices can presently be purchased at around $8.00 from large retailers like Woolworths. At that price, today's manufacturers (in Asia, of course) are not likely to be able to afford to recycle millions of dud smoke detectors.

The big advantage of smoke detectors is that they can save lives. Let's not complicate their use by requiring that they must be returned for recycling at some time in the future.

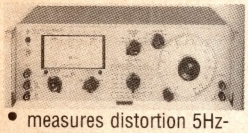
Leo Simpson

WARNING!

SILICON CHIP magazine regularly describes projects which employ a mains power supply or produce high voltage. All such projects should be considered dangerous or even lethal if not used safely. Readers are warned that high voltage wiring should be carried out according to the instructions in the articles. When working on these projects use extreme care to ensure that you do not accidentally come into contact with mains AC voltages or high voltage DC. If you are not confident about working with projects employing mains voltages or other high voltages, you are advised not to attempt work on them. Silicon Chip Publications Pty Ltd disclaims any liability for damages should anyone be killed or injured while working on a project or circuit described in any issue of SILICON CHIP magazine. Devices or circuits described in SILICON CHIP may be covered by patents. SILICON CHIP disclaims any liability for the infringement of such patents by the manufacturing or selling of any such equipment. SILICON CHIP also disclaims any liability for projects which are used in such a way as to infringe relevant government regulations and by-laws.

Advertisers are warned that they are responsible for the content of all advertisements and that they must conform to the Trade Practices Act 1974 or as subsequently amended and to any governmental regulations which are applicable.

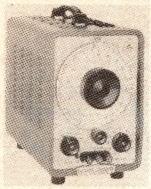
HEWLETT PACKARD 334A Distortion Analyser



- measures distortion 5Hz-600kHz
- harmonics up to 3MHz
- auto nulling mode
- high pass filter
- high impedance AM detector

$1050

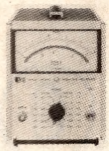
HEWLETT PACKARD 200CD Audio Oscillator



- 5Hz to 600kHz
- 5 ranges
- 10V out
- balanced output

$79

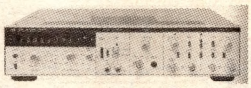
HEWLETT PACKARD 3400A RMS Voltmeter



- voltage range 1mV to 300V full scale 12 ranges
- bB range - 72dBm to +52dBm
- frequency range 10Hz to 10MHz
- responds to rms value of input signal

$475

HEWLETT PACKARD 5328A Universal Counter



- allows frequency measurements to 500MHz
- HPIB interface
- 100ns time interval
- T.I. averaging to 10 ps resolution
- channel C @ 50ohms

$695

HEWLETT PACKARD 5340A Microwave Counter

- single input 10Hz - 18GHz
- automatic amplitude discrimination
- high sensitivity -35dBm
- high AM & FM tolerance
- exceptional reliability

$1950

HEWLETT PACKARD 3336B Synthesizer/ Level Generator

- Frequency coverage 10Hz-20.9MHz
- Precise frequency & spectral purity 1 Microhertz res up to 100kHz
- Absolute amplitude accuracy ±.05dB at 10kHz
- Unique levelled sweep capabilities

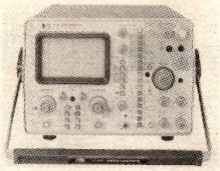
$1650

HEWLETT PACKARD 3586B Selective Level Meter

- Frequency coverage 50Hz-32.5MHz
- Excellent measurement accuracy ±.2dB
- Autoranging & automatic calibration
- SSB mode provides demodulation capability
- HPIB programmable

$1450

HEWLETT PACKARD 1740A Oscilloscope



- DC-100MHz bandwidth
- 2-channel display mode
- trigger - main/delay sweep
- coupling AC, DC, LF rej, HF rej

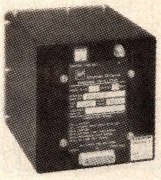
$990

HEWLETT PACKARD 141T/8552/8555A Spectrum Analyser

- variable persistence storage mainframe
- internal graticule eliminates parallax error
- IF section 10Hz minimum bandwidth
- log & linear sens. control
- absolute amplitude accuracy to ±1.6dB
- direct coax input to 18GHz
- high res. 100Hz bandwidth

$3995

BALL EFRATOM M100 Rubidium Frequency

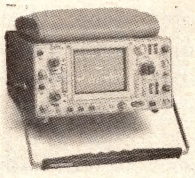


- factory cal certs
- perfect for ISO accreditation
- GPS applications
- ruggedised military design

$2950

AWA A215-2 Transmission Measuring Set	$175
AWA E221 Level Meter	$650
AWA F240 Distortion & Noise Meter	$425
AWA G231 Audio 10Hz-30KHz	$495
AWA G251 Level Oscillator 50Hz-2MHz	$600
BECKMAN L10A Megohmeter	$1400
EATON 2075 Noise Gain Analyser	$6500(ex)
ESI DB62 Decade Box	$350
EUROCARD 6 Slot Frames	$40
GR 1381 Random Noise Generators	$160
HP 332A Distortion & Noise Meter	$495
HP 400EL AC Voltmeter	$195
HP410C Multimeter	$295
HP 427A Voltmeter	$95
HP 432A Power Meter C/W Head & Cable	$825
HP 652A Test Oscillator	$375
HP 1222A Oscilloscope DC-15MHz	$410
HP 3406A Broadband Sampling Voltmeter	$575
HP 3455A 61/2 Digit DVM	$650
HP 3490A 51/2 Digit Digital Multimeter	$295
HP 4204A Oscillator 10Hz-1MHz	$350
HP 5245L/5253/5255 Electronic Counter	$550
HP 5300/5302A Universal Counter to 50MHz	$195
HP 5326B Universal Timer/Counter/DVM	$295
HP 5335A High Perf 200MHz Universal Counter	$4500
HP 8005A Pulse Generator 20MHz 3-Channel	$350
HP 8405A Vector Voltmeter (with Cal Cert)	$1100
HP 8690B/8698/8699 400KHz-4GHz Sweep Osc	$2450
HP 8690B/8707A/8706A 4GHz-18GHz Sweep Osc	$1500
MARCONI TF2300A FM/AM Mod Meter 500kHz-1000MHz	$450
MARCONI TF2500 AF Power/Volt Meter	$180
MOTOROLA Sinad Meter	$325
NORTHEAST 4002A Transmission Measuring Set	$600
RACAL DANA 9500 Universal Timer/Counter	$350
SD 6054B Microwave Freq Counter 20Hz-18GHz	$2500
SD 6054C Microwave Freq Counter 1-18GHz	$2000
TEKTRONIX 465 Oscilloscope DC-100MHz	$1190
TEKTRONIX 475 Oscilloscope DC-200MHz	$1550
TEKTRONIX 602 XY Display	$350
TEKTRONIX 7603NIIS Oscilloscope DC-65MHz	$650
TEKTRONIX 7904 Oscilloscope DC-500MHz	$2800
W&G SPM3 Selective Level Meter C/W; W&G PS3 Signal Generator 300Hz-612kHz	$450pair
WAVETEK 143 Function Generator 20MHz	$475
RADIO COMMUNICATIONS TEST SETS	
IFR500A	$8750
IFR1500	$12,000
SCHLUMBERGER 4040	$7500

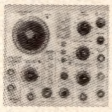
TEKTRONIX 475A Oscilloscope



- 250MHz bandwidth
- 2-channel display mode
- trigger - main/delay sweep
- coupling AC, DC, LF rej, HF rej

$1690

TEKTRONIX FG504/TM503 40MHz Function Generator



- 0.001Hz-40MHz
- 3 basic waveforms
- built-in attenuator
- phase lock mode

THIS MONTH'S SPECIAL BONUS: **DM501 Multimeter**

$1290

BALLANTINE 6310A Test Oscillator

- 2Hz-1MHz freq. range
- digital counter with 5 digit LED display
- output impedance switch selectable
- output terminals fuse protected

$350

BALLANTINE 3440A Millivoltmeter

- true RMS response to 30mV
- frequency coverage 10kHz-1.2GHz
- measurement from 100µV to 300V
- accuracy ±1% full scale to 150MHz
- list price elsewhere over $5500

$795

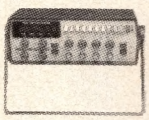
SAMPO *NEW EQUIPMENT* LODESTAR

The name that means quality — **Affordable Laboratory Instruments**

SSI-2360 60MHz Scope

- 60MHz dual trace, dual trigger
- Vertical sens. 1mV/div.
- Maximum sweep rate 5ns/div.
- Component tester
- Delay sweep, single sweep
- Two high quality probes

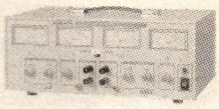
$1110 + Tax



Function Generator 2/5MHz High Stability FG1617 & FG 1627

- Multiple waveforms
- 1Hz to 10MHz Counter
- Output 20V open
- VCF input
- Var sweep lin/log
- Pulse output TTL/CMOS

FG1617 $340 + Tax
FG1627 $390 + Tax



PS303D Dual Output Supply

- 0-30V & 0-3A
- Four output meters
- Independent or Tracking modes
- Low ripple output

$420 + Tax

PS305D Dual Output Supply

- 0-30V and 0-5A

$470 + Tax

PS303 Single Output Supply

- 0-30V & 0-3A
- Two output meters
- Constant I/V

$265 + Tax

PS305 Single Output Supply

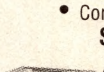
- 0-30V & 0-5A

$300 + Tax

PS8112 Single Output Supply

- 0-60V & 0-5A

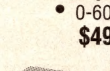
$490 + Tax



Audio Generator AG2601A

- 10Hz-1MHz 5 bands
- High frequency stability
- Sine/Square output

$245 + Tax



Pattern Generator CPG1367A

- Colour pattern to test PAL system TV circuit
- Dot, cross hatch, vertical, horizontal, raster, colour

$275 + Tax

MACSERVICE PTY LTD

Australia's Largest Remarketer of Test & Measurement Equipment

20 Fulton Street, Oakleigh Sth, Vic., 3167 Tel: (03) 9562 9500 Fax: (03) 9562 9590

**Illustrations are representative only

Pt.2: user programmable systems vary the maps

Automotive Ignition Timing

Programmable engine management ECUs are now allowing specialist manufacturers to devise their own ignition maps. Here's a quick look at what's involved.

By JULIAN EDGAR

The use of programmable engine management ECUs has meant that ignition timing maps can be developed which take into account more than just load and engine speed. Correction for varying intake air and engine coolant temperatures can be provided and much greater advance can be specified than was possible with conventional distributors.

While initially affecting only those developing highly-modified road cars or race machines, the freedom of having total ignition timing control meant that new fields had to be explored. Craig Allan is one of the few people formally qualified (he has a Diploma in Engineering) and also active in the modified automotives field. Working with son Adam, the Adelaide-based principal of Allan Engineering says: "What computer engine management did was teach us that we still had a lot of learning to do".

The advent of programmable engine management ECUs has meant that there is total freedom in devising ignition maps. Any advance can be specified at any load and RPM, with corrections able to be made on the basis of input from the coolant and inlet air temperature sensors, knock sensor and so on.

With manufacturers selling programmable engine management systems in the field, there was also a need for a major educational campaign. Australian manufacturer Invent Engineering (maker of Haltech programmable engine management ECUs) decided that a formal warning about the dangers of improper ignition timing should preface the running of their software. *"WARNING: Poorly adjusted ignition timing can damage your engine... Engine failure can cause an engine to explode and cause a potential vehicle accident ..."* reads their statement in part. It goes on to suggest that you return their product if you are unhappy with this idea!

However, for the programmable engine management manufacturers to be able to sell their products, some ignition timing guidelines are needed. Ironically – considering the gravity of their warning – Haltech are amongst the best in facilitating the development of ignition maps. The QuickMAP system used by their proprietary software requires only the input of an 8-digit alphanumeric code to configure an ignition timing map for all engine loads.

An example of the code used is '15A38D10'. This is translated as follows:

- 15 – ignition timing advance angle at idle;
- A – 1500 RPM for full ignition advance ('A' indicates 1500 RPM, 'B' 2000 RPM, etc);
- 38 – full load ignition advance angle;
- D – an additional 9° light load advance ('D' indicates 9°, with each ad-

The use of a chassis or engine dynamometer allows the best tuning of the ignition map. Torque output, exhaust gas analysis and combustion temperature can all be monitored.

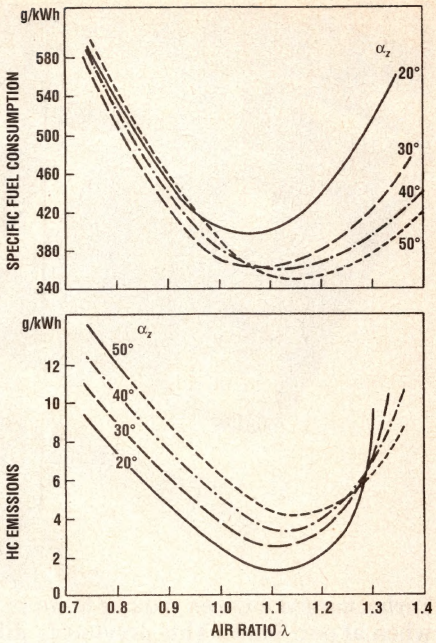


Fig.1: the ignition timing which gives the best hydrocarbons emissions also gives the worse specific fuel consumption. Devising an ignition map which is optimal depends on the engine's application. (Bosch)

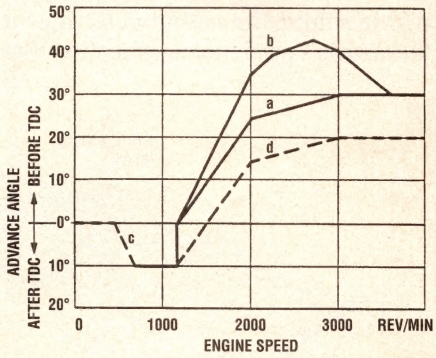


Fig.2: retarding the ignition timing to after TDC is useful for reducing exhaust emissions. In the above graph, 'a' is the timing curve for full load, 'b' is for part load, 'c' is at idle and 'd' is when the vehicle is overrunning the engine. (Bosch)

ditional alphabet placing from 'B' meaning another 3°);

• 10 – ignition timing retard angle under boost (when using a turbo or other supercharger).

The resultant ignition timing map is not intended to be the final product but it provides a good starting point for subsequent tuning. An example of the type of timing map produced with this system is shown in Fig.5. It is for all loads, from -100kPa manifold pressure to more than +100kPa boost at 4000 RPM on a turbocharged engine. The arbitrary reduction under boost conditions provided by the QuickMAP is readily apparent; this sudden step would be smoothed in due course by the operator to provide an ignition advance which varied more in keeping with the actual turbocharger boost pressure.

Incidentally, like almost all programmable engine management systems, the Haltech approach uses a MAP (manifold absolute pressure) sensor to determine load, rather than an airflow meter.

The production of an ignition map for the Haltech system takes only a few moments, while for some programmable systems several hours would need to be spent programming each load site. Interestingly, when using a chassis dynamometer to tune this Haltech system on a Nissan FJ20 turbocharged engine, the author and mechanic Paul Keen found detonation intruding at about 2000 RPM on 25kPa boost. A revised QuickMAP incorporating 15° of boost retard (versus the original 10°) cured the problem, with the speed of the remedy impressive.

Another programmable engine management manufacturer gives an example of a 'very basic' ignition advance curve. Advanced Engine Management Systems (manufacturer of the Wolf 3D system) provides a table of ignition advances and engine speeds. It looks, in part, as shown in Table 1.

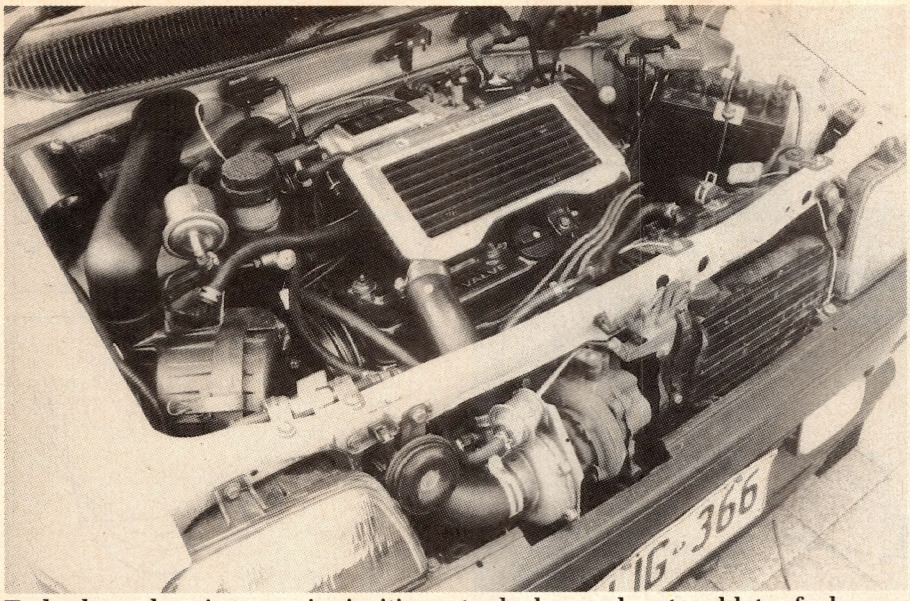
The reason for the timing being more advanced at 500 RPM than at 1000 RPM is to provide a stable idle speed. This occurs because if the engine starts to slow down from its designated idle setting, the greater ignition advance causes the engine to produce more torque, thereby increasing the engine speed back to its correct value.

Tuning ignition maps

Given that incorrect timing can cause major engine damage or at the least degrade performance, the tuning of the ignition map is critical. Most people programming engine management systems use a chassis dynamometer, where power and torque readings at the driving wheels can be measured. Others use an engine dynamometer which requires the engine to be removed from the vehicle for the initial tuning.

Depending on the quantity and quality of the instrumentation available, exhaust gas analysis, combustion temperatures, torque output and other factors may be measured, or the ignition

Table 1: Basic Ignition Timing Advance					
RPM	500	1000	1500	2000	2500
Advance	10°	8°	12°	15°	17°



Turbocharged engines require ignition retard when on boost and lots of advance when at part loads. This previously difficult task is eased by the use of programmable ignition systems.

tuning may be carried out using just the operator's ears to listen for knocking.

No ignition map is ever perfect and so the operator's skill plays a large part in setting the optimum timing for the engine's particular application. For example, the ignition timing map which gives the best results for fuel consumption is not the best for NOx emissions. In addition, a map designed to give maximum power with higher octane fuel will have poor knock-resistance if used in a vehicle subjected to varying fuel quality. However, because the most common use of programmable engine management is in motor sport or road-performance applications, most systems are set up for maximum power combined with good driveability.

Paul Keen is another mechanic who is well-used to setting up ignition timing systems. Over years of tuning mechanical advance systems on a chassis dyno, he has developed several rules of thumb which provide starting points for further refinement. Generally, he finds that, on 4-cylinder engines, a total advance of 36° is appropriate, with 32° total being used on sixes.

The variation with V8s is wider, anywhere from 28-36° being used, depending on the engine and its state of tune. The variation relates more to combustion chamber design than any other factor: 4-cylinder engines (especially in the past) are better in this area than the larger engines.

Idle speed advance

The appropriate idle advance relates more to the engine compression ratio than to any other factor, suggests

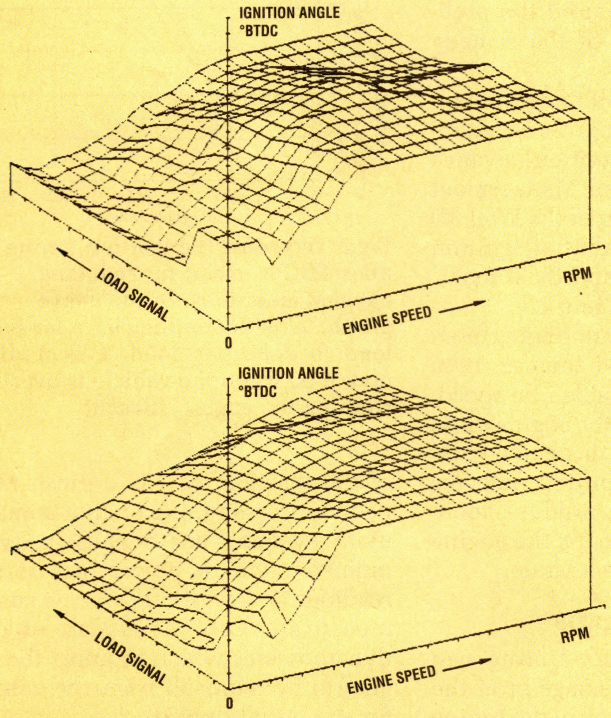


Fig.3: these are Bosch Motronic ignition maps. The top is for premium fuel, while the bottom map is for regular fuel. While virtually identical in the low-load range, at higher loads the 'premium' map uses more advance. (Bosch)

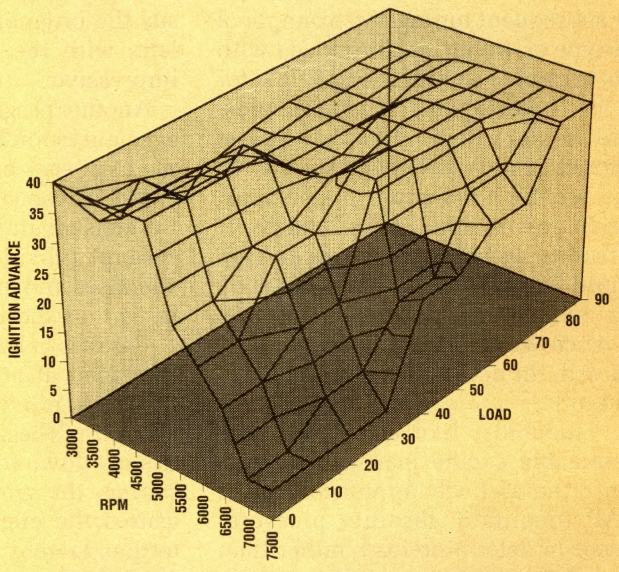


Fig.4: part of an ignition map from a 418kW (560 bhp) Group A Holden V8. The advance is highest at low loads and RPM. Note the required 'peaks' and 'valleys' as a result of tuning the engine on a dynamometer.

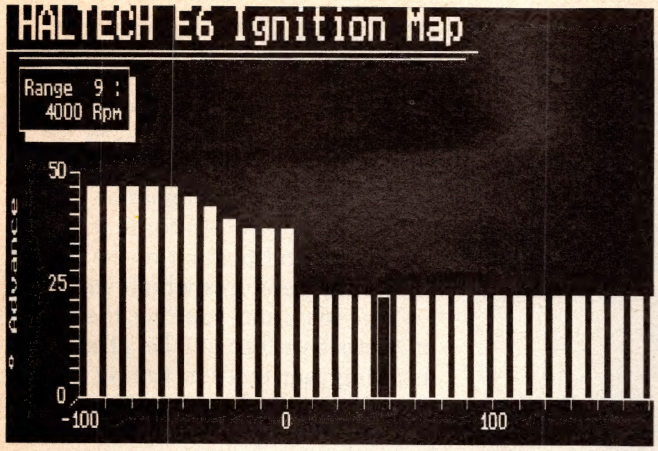


Fig.5: the QuickMAP facility of Haltech programmable engine management allows the production of ignition maps with the input of just an 8-digit code. This provides the starting point for further modifications.

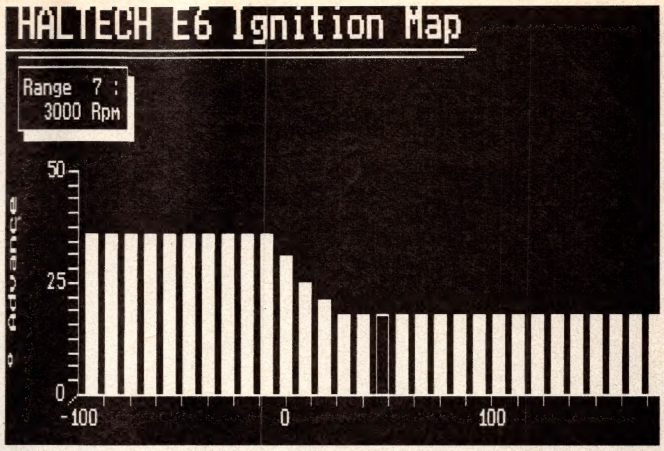


Fig.6: this Haltech ignition curve is for 3000 RPM on a turbocharged engine. Each of the individual bars on the curve can be raised or lowered to give timing changes at each load site.

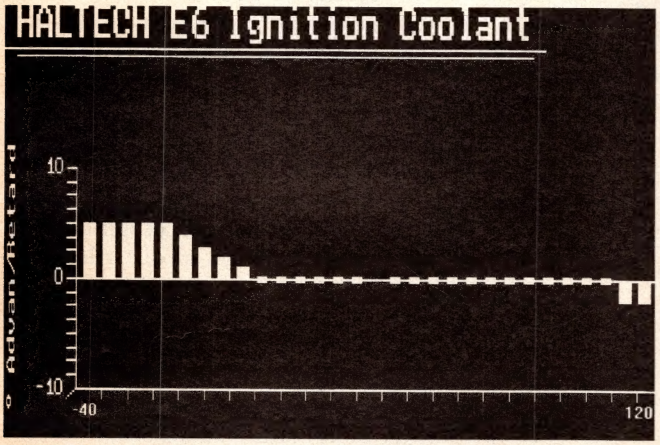


Fig.7: this correction chart allows the ignition timing to be changed on the basis of coolant temperature. Note the increase in timing advance at low temperatures and the decrease when the engine is overheating.

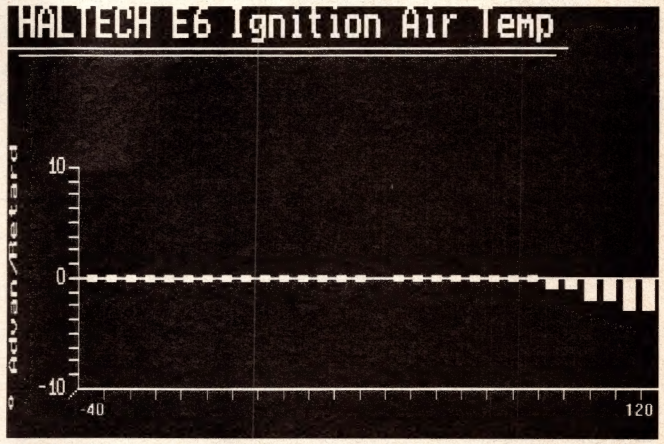


Fig.8: this correction chart allows ignition retard to be programmed for when induction air temperatures are high. This is especially required in a turbocharged car which does not have effective intercooling.

Adam Allan. Engines with a compression ratio of 8:1 will accept an ignition advance of anything from 0-20° without kickback on starting. A 10:1 compression ratio will reduce this to 15°, 11:1 to around 10-12°, while race engines using the very high compression ratios of 12:1 or 13:1 can sometimes tolerate no ignition idle advance at all.

The rate at which the timing advances from the static (or idle) timing is another variable. "Some engines like an early full advance and others don't", said Paul Keen. "The Falcon cross-flow six, for example, pings with an early full advance." Adam Allan suggests that the point at which maximum timing advance is reached should correspond to the RPM at which the wide-open throttle engine's torque output has started to decline. If exhaust gas temperature readings are being made, he suggests that optimal ignition timing is that which gives the lowest exhaust gas temperature combined with timing advanced sufficiently to give maximum torque. A 2-3° retard of the advance angle from the point of detonation provides a sufficient safety margin, he believes.

At light loads, as used in everyday cruise conditions, an advance of up to 40° will improve responsiveness and economy. This figure is greater than generally used by traditional mechanically controlled timing systems but is easily achievable with programmable ignition. Adam Allan has seen this advance used successfully on many engines, even those with an 11:1 compression ratio and running on Avgas.

Examples of ignition maps

While programmable ECU ignition maps are the result of many hours spent using dynos and so are intellectual property worth thousands of dollars, we managed to find two sources prepared to reveal some of this information. Paul Keen of Adelaide's Darlington Auto Tune allowed access to Haltech E6 software maps developed for a turbocharged FJ20 2-litre Nissan engine, while Craig and Adam Allan released ignition maps written using Autronic SMII software for a Holden Group A racing V8 and for a Ford 289 V8.

Fig.4 shows the ignition advance map for 3000-7500 RPM of the Group A V8. Using a 10:1 compression ratio and a high octane fuel, a maximum power output of 418kW at 7100 RPM was measured. As expected, the advance at low loads remains high (at 40°) until 5000 RPM but drops to just 5° at 7500 RPM. Low loads at 7500 RPM would simply not be seen in this

A laptop PC, a chassis dynamometer with power and torque readouts, exhaust gas analysis equipment and a skilled operator are needed to set up programmable ignition (and fuel) ECUs.

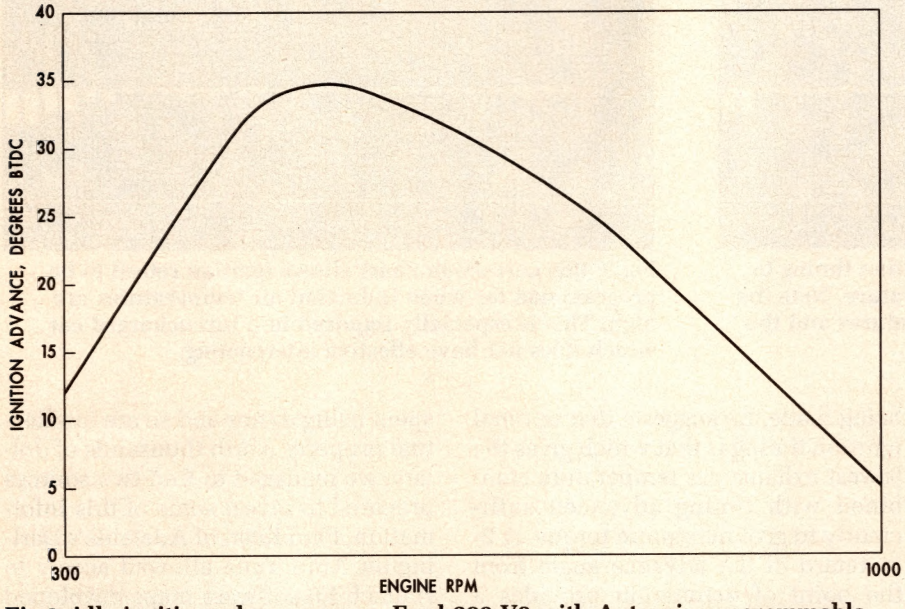


Fig.9: idle ignition advance curve, Ford 289 V8 with Autronic programmable engine management. The idle speed is made self-stabilising to some degree by the use of this low RPM timing curve.

race engine and so little dyno tuning was carried out in this area.

As loads increase, the ignition advance is greater at all RPM and is nothing like the curve provided by mechanical advance mechanisms. However, of greatest interest are the required peaks and troughs in this ignition map, which was developed with the engine being loaded by an eddy-current engine dynamometer and with full data logging being used.

Incidentally, Fig.4 was drawn from the Autronic program data (which is normally expressed in tabular form) using Excel software.

The ignition maps shown here for the FJ20 turbo engine are printed directly from the Haltech E6 program which uses on-screen bargraphs to show the ignition advance. Fig.6 shows a 3000 RPM ignition timing map, with load on the horizontal axis. Note the reduction in advance which occurs under positive manifold pressure; ie, when boost is provided by the turbo.

Fig.7 shows a correction chart based on coolant temperature. Up to 10° of advance or retard can be used to modify the map developed on the basis of load and RPM. While this map shows no modification of the timing for the temperatures which would be realised in normal running, the height of these bars can all be changed – meaning that ignition timing can be modified on the basis of coolant temperature with great resolution, if desired.

The second of the Haltech ignition correction charts (Fig.8) has even more potential, especially in turbo engines. Turbochargers heat the intake air as they compress it and a hot induction charge is much more likely to cause detonation than one at ambient temperatures. Intercooling is often provided to reduce the possibility of detonation and to increase power.

However, an ignition map which can reduce the amount of ignition advance on the basis of air inlet temperature has the potential to allow very high engine efficiencies by running boost timing which is retarded only a little – but which greatly reduces the timing advance as the air inlet temperature increases.

Idle ignition curve

Fig.9 shows the idle ignition curve for a 289 Ford V8 with Autronic programmable engine management. The car uses an automatic transmission and does not have an air idle-speed control valve, meaning that idle speed control when the car is placed in and out of 'drive' is carried out mostly by ignition control.

The 300 RPM advance of 12° is for starting while the 34° advance at 450 RPM helps bring the engine back up to idle speed when sudden loads are placed on it. The advance of only 5° at 1000 RPM helps slow the engine, bringing it back to the correct idle RPM. **SC**

Acknowledgements

Thanks to Allan Engineering (085) 22 1901 and Darlington Auto Tune (08) 277 4222, both of Adelaide, SA, for their assistance in the preparation of this article.

New regulations to reduce the problem of

Electromagnetic Interference

From January 1996 the Spectrum Management Agency (SMA) will begin to phase-in an EMC standards framework to control the sources and effects of electromagnetic interference.

The standards will be enforceable from January 1997 and will most directly affect manufacturers, agents of overseas manufacturers and direct importers of electrical and electronic products.

An ***Information for Suppliers*** booklet has been prepared by the SMA to advise of the new arrangements.

To obtain a copy of the booklet suppliers can contact the Spectrum Management Agency on 1800 642 187.

To assist industry in the transition to the new standards a series of programs have been developed by the Department of Industry, Science and Technology. These will be delivered through the Australian Electronics Development Centre.

For information on these programs contact the AEDC on 03 9302 1422.

Electromagnetic Compatibility

Spectrum Management Agency

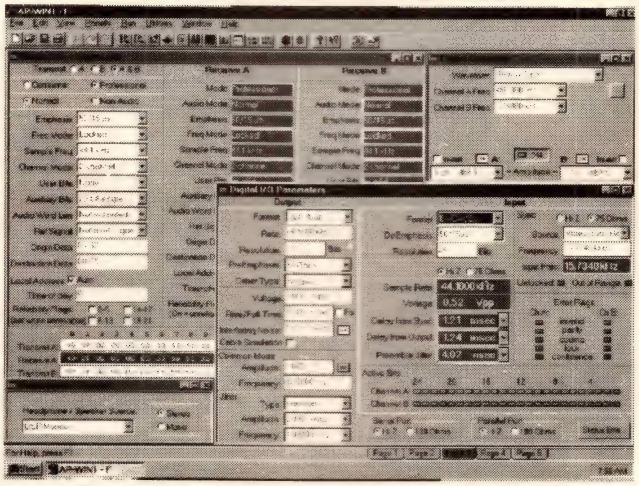
120 x 181

APWIN® audio testing offers the benefits of the world's most popular graphical interface

- True Windows®-based control, manipulating and exporting of data
- Assemble 'virtual test benches' – ideal for automated testing
- Display 5 different pages – panels, bargraphs, X-Y graphs of 6 variables
- Keyboard macro's for writing test procedures
- Windows printing/plotting interface

APWIN software builds on Audio Precision's 10 years experience of controlling audio test instruments with PCs. It provides the greatest display flexibility for System 1 and 2 and allows you to do several things at once. Software equalisation can be applied to any swept stimulus or measurement.

Data can be linked to other Window's applications – spreadsheets for example, for further computation or presentation of results.



Status bits and Parameters panels provide information and control of digital I/O

Audio precision

System 2

- Comprehensive PC-controlled signal generator and analyser for digital and analogue audio
- True dual domain architecture – separate analogue and digital hardware (no performance limiting converters)
- Complete facilities for measurement to AES3 – jitter, FFT of jitter, pulse amplitude, eye patterns, delay etc
- Simulate real-world degradation, inject variable jitter, vary rise/fall times etc
- Locks to virtually any house signals including PAL video etc

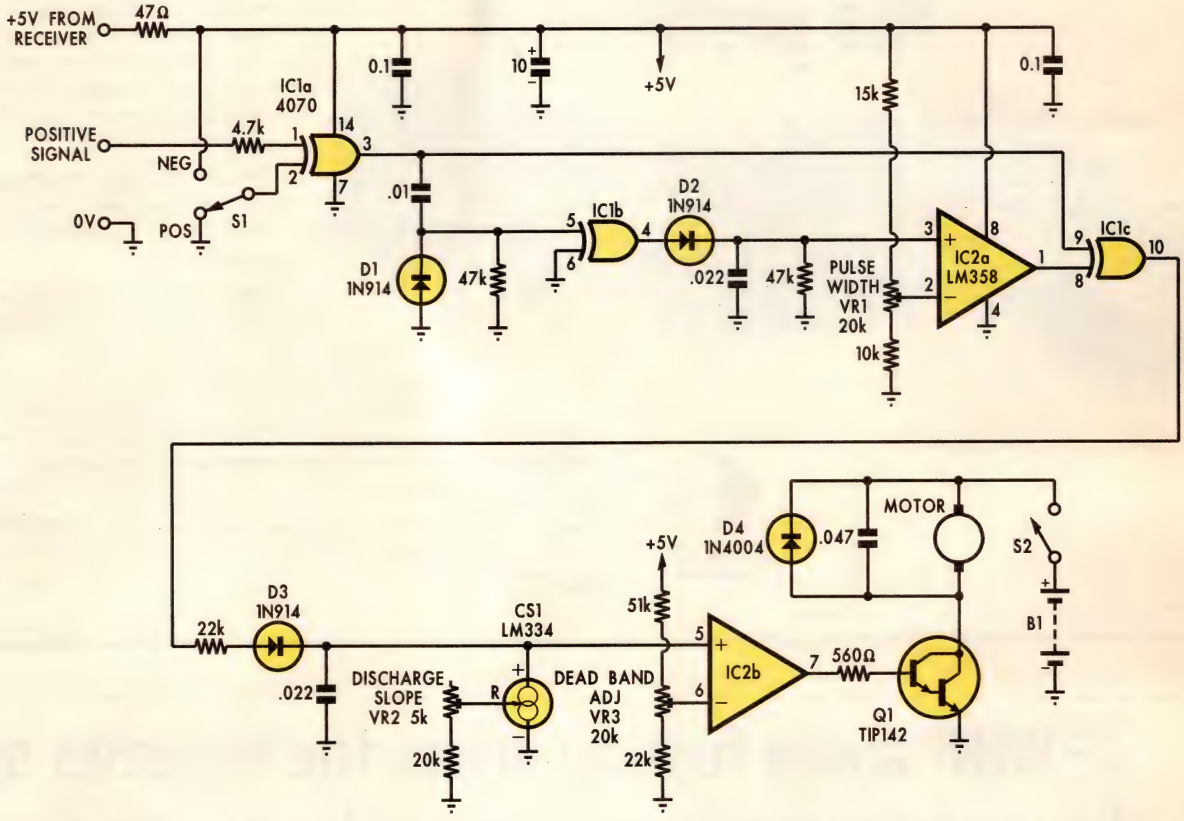
IRT

IRT Electronics Pty Ltd

26 Hotham Parade, Artarmon, N S W 2064. Tel : (02) 439 3744 Fax : (02) 439 7439
Victoria : 3/395 Nepean Highway, Frankston 3199. Tel : (03) 9770 1965 Fax : (03) 9769 6044

CIRCUIT NOTEBOOK

Interesting circuit ideas which we have checked but not built and tested. Contributions from readers are welcome and will be paid for at standard rates.



Speed controller for small motors in models

This speed controller can be used to drive small motors in model R/C applications.

The circuit consists of two ICs: a quad XOR gate (4070) and a dual op amp (LM358). It is powered from the receiver's battery via the servo lead.

Pulses from the receiver are fed via a 4.7kΩ resistor to pin 1 of IC1a which acts as either an inverting or non-inverting buffer stage, depending on the position of S1. For positive pulse receivers (eg, JR, Futaba, etc), pin 2 is switched low.

The rising edges of the buffered 1-2ms pulses on pin 3 are differentiated using a .01μF capacitor and a 47kΩ resistor and the negative portion of the waveform is clipped by D1. This signal is then fed to pin 5 of IC1b. Each time the voltage on pin 5 exceeds ½Vcc, pin 4 of IC1b goes high to give a series of narrow pulses.

Each of these pulses rapidly charges a .022μF capacitor via D2, with the capacitor then slowly discharging via a parallel 47kΩ resistor in between pulses. The resulting sawtooth waveform is then compared in IC2a with a preset reference voltage on pin 2. VR1 adjusts this reference voltage so that IC2a outputs a 1ms pulse train.

The pulses from IC1a & IC2a are compared by IC1c. When these pulses are in-phase and of equal duration, pin 10 of IC1c remains low. However, when the number of receiver pulses increases (stick forward), a difference pulse appears at IC1c's output. Thus, depending on the control stick position, the pulses on pin 10 of IC1c may vary in width between 0 and 1ms.

These pulses must be stretched in order to drive the motor. This is achieved by producing another sawtooth voltage with variable DC shift and comparing it with another reference voltage in IC2b. In this case, the sawtooth voltage is produced by charging a .022μF capacitor via D3 and discharging it via an adjustable current source based on an LM334. This ensures that the capacitor ramps down in a linear fashion.

The reference voltage on pin 6 of IC2b is adjusted (using VR3) to about 1.2V, giving a deadband (off) for the first 20% of stick travel. The pulse width at the pin 7 output then increases from that point until the stick is fully forwards. This output drives Darlington transistor Q1 which then pulses the motor on and off at about 50Hz (20ms).

Q1 can handle loads up to 120W if properly heatsinked. A 1A diode is connected across the motor to protect the transistor from back-EMF. Trimpots VR1-3 are adjusted using an oscilloscope.

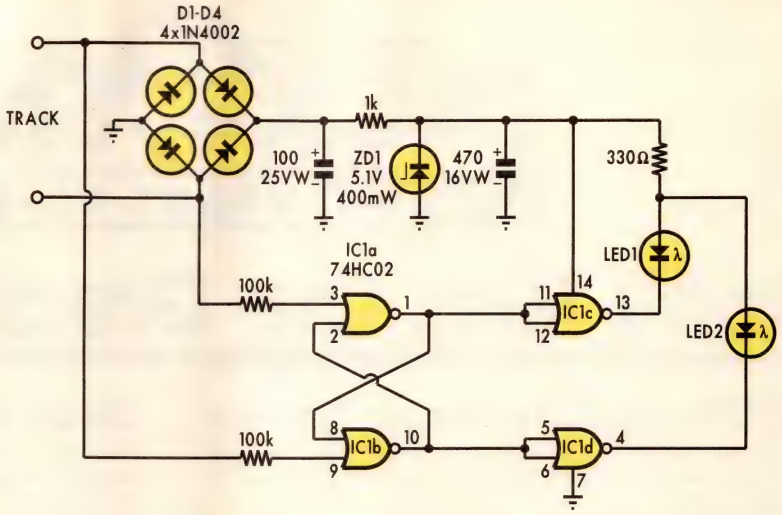
Manfred Schmidt,
Edgewater, WA. ($35)

Adding tail lamps to guard's vans

This circuit is for adding tail lamps to guard's vans on model railways. It provides directional control for the lights which can be added using high intensity red LEDs with 1mm optical fibre links.

D1-D4 provide a positive voltage to the 100µF capacitor regardless of the track polarity. The 1kΩ resistor limits the current to ZD1, which then provides 5V for IC1.

When the upper track input is positive, pin 9 of IC1b will be positive and thus pin 10 will be at ground. This means that both inputs of IC1a will be at ground and so its output (pin 1) will be at +5V. IC1c inverts this high and so LED 1 will light via the 330Ω resistor.



At the same time, pin 4 of IC1d will be at +5V and so LED 2 will be extinguished. When the track polarity changes (eg, when the locomotive is reversed), LED 2 lights and LED 1 turns off.

Stephen Ives,
Tamworth, NSW. ($20)

Low-cost stepper motor & controller

Looking for a low-cost stepping motor and a controller? Surplus 5.25-inch floppy disc drives are cheap and the stepper motors that control head movement in these drives can be adapted to a variety of uses. What's more, the controllers for these drives are easy to use.

All that one has to do is remove the PC board and stepper motor from the drive, connect them together, and connect the PC board to the "outside world". The only connections required are to a suitable power supply plus four connections to the interface socket. These latter four connections control the motor.

The procedure is as follows:

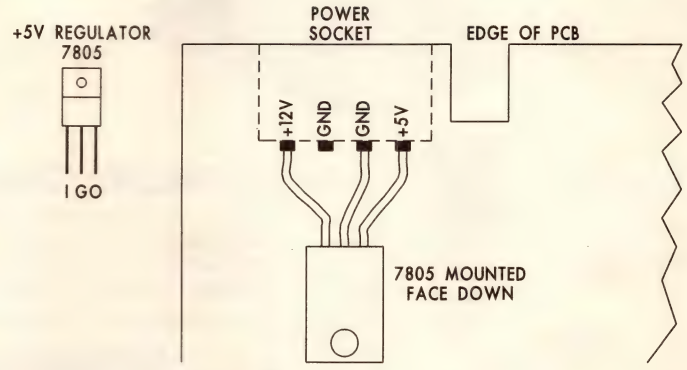
(1). Connect the ground (0V return) to any of the odd numbered pins;

(2). Connect a lead to pin 14 if the disc drive was drive 1, or to pin 12 if it was drive 2. This is "drive select" and is necessary for the drive logic to be selected;

(3). Connect a lead to pin 18. The logic on this pin determines the step direction; ie, high = step out, low = step in. This works in conjunction with pin 20 (the step input);

(4). Connect a lead to pin 20. This is the "step" command; a logic low on this pin will make the motor step.

Because the logic is normally high and the various signals are active low, the motor can be controlled using transistors, switches or relays. Note that the drive will ignore signals on the interface unless its drive select pin is low. It is possible to control up to four motors at once using a parallel set of control leads, simply by switching the drive select pins.



Finally, the drive will require +12V and +5V rails. The way around this is to use a +12V 1A supply and derive the +5V rail using a 7805 3-terminal regular. The diagram shows how this is done. The input of the regulator goes to the +12V connection on the power socket, the ground pin to either of the two ground connections, and the output to the +5V connection.

Jeff Allen,
Canberra, ACT. ($30)

Pin Assignments For Floppy Disc Connector

Ground	Signal	Description
1	2	Reduced write current/rpm
3	4	N.C.
5	6	N.C.
7	8	Index
9	10	Motor on 1/Drive select 3
11	12	Drive select 2
13	14	Drive select 1
15	16	Motor on 2/Drive select 4
17	18	Direction select
19	20	Step
21	22	Write data
23	24	Write enable
25	26	Track 00
27	28	Write protect
29	30	Read data
31	32	Head select
33	34	Disc change

DICK SMITH ELECTRONICS

Don't Miss Our Great Low Prices!

WTCPS Quality Solder Station

Its non-burning silicon rubber power cable and long-life, iron-plated tip make this Weller soldering station very reliable. It also has 48 watts capacity, low voltage internal transformer, lightweight soldering pencil and special "closed-loop" temperature control. Complete with stand and cleaning sponge.

Cat T-3000

$179

BONUS Side Cutters (T-2999) valued at $29.95

UH-053 UHF CB

Provides coverage of the first 16 channels of the UHF CB band, with selectable repeater operation on channels 1-8 inclusive. Simplex operation on all 16 channels is selectable if repeater access is not required. Supplied with a NiCad battery pack, AC charger, belt-clip, and flexible antenna, ready for operation. An optional speaker/microphone (D-2025) is also available for more convenient belt-mounted usage.

Cat D-1753

$269

BONUS Speaker Microphone (D-2025) valued at $69.95

uniden.

30g Can Of Ronson Butane Gas

Cat N-1082

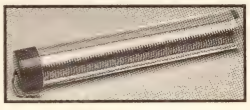
Save Over 15% **$2.95**

Solder Hobby Tube

17g. 1mm solder. Easy to dispense.

Cat N-1637

$1.50



Sloping Plastic Cases

High quality plastic cases with 2mm thick aluminium panels suitable for housing a variety of kits. With provision for PCB mounting, they come complete with rubber feet and screws.

Small - panel size: (approx)120 x 187mm

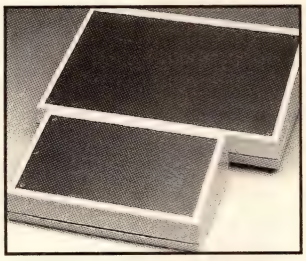
Cat H-2911

$24.95

Large - panel size: (approx)162 x 250mm

Cat H-2912

$34.95



7VCT/7.5V @ 1.8VA Transformer

Secondary Output: 3.5-0-3.5V & 0-7.5V

Secondary Current: 250mA & 10mA

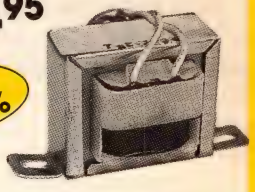
Terminations: Flying Leads

Dimensions: 33(h) x 59(w) x 29(d)mm

Cat M-2824

$4.95

Save Over 25%



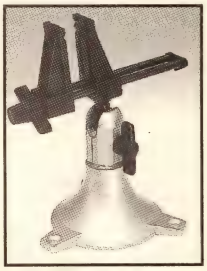
PanaVice Jr. PCB Vice

You'll find this vice handy when both hands are tied up working with PCBs. It holds the board firmly between adjustable tough plastic clamps, while the head assembly can be rotated and tilted. Features a diecast base, which can be screwed to a workbench.

Made in USA.

Cat T-4740

$49.95



Lead-free Solder

99.3% tin/ 0.7% copper alloy. Melting point of 227°C. 200g roll (0.71mm DIA).

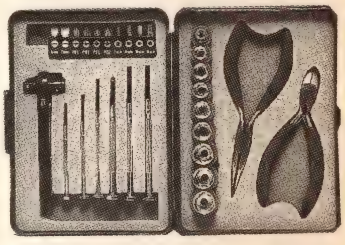
Cat N-1628 **$9.95**

28-Piece Compact Tool Kit

A convenient collection of tools complete with a foam-lined plastic storage case. Includes 9-piece Hex Nut drivers and quality reversible ratchet handle, 6-piece Jewellers screwdrivers, side-cutters, pliers, plus 10-piece assorted screwdriver bits.

Cat T-4610

$39.95



Don't forget your copy of BENCHMARK! Now available free in your nearest store.

Need a Multimeter?

Choose from one of Australia's largest ranges! Our huge selection of multimeters caters for everyone from the hobbyist to the professional.

Mini Multimeter

- 2K/Volt Sensitivity

Cat Q-1004

$16.95

19 Range Multimeter

- 20K/Volt Sensitivity

Cat Q-1023

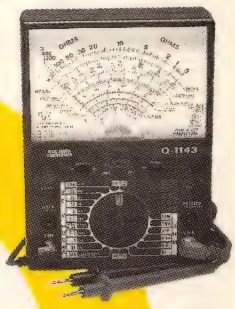
$39.95

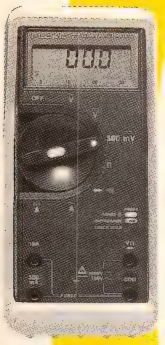
Electronic FET VOM

- Reads Pk-Pk & RMS
- High Input Impedance

Cat Q-1143

$109.50





3999 Count Digital Multimeter

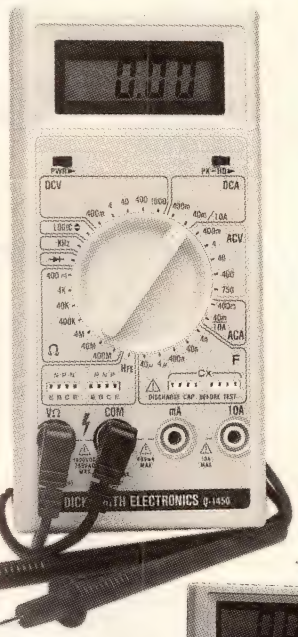
- Large 13mm 3.75 digit LCD display
- Auto-polarity
- Capacitor/diode/transistor/logic circuit test
- Frequency measurement (up to 4MHz)
- Peak reading hold
- Carry case & test leads

Ranges:

DCV:	400mV, 4V, 40V, 400V, 1000V
ACV:	400mV, 4V, 40V, 400V, 750V
DC Current:	40mA, 400mA, 10A
AC Current:	40mA, 400mA, 10A
Resistance:	400, 4K, 40K, 400K, 4M, 40M, 400Mohms
Trans. check:	Hfe (NPN/PNP)
Capacitance:	4nF, 40nF, 400nF, 4uF, 40uF
Freq. Measure:	Auto-ranging 4k-4MHz (4 scales)
Logic Measure:	TTL type

Cat Q-1450

$129.50

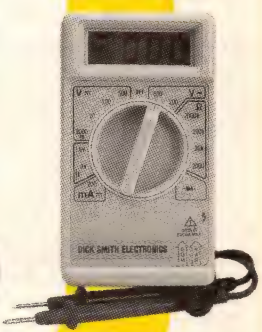


3.5 Digit

- 14 Range
- Diode Test

Cat Q-1420

$29.95



Fluke 77 3.75 Digit

- Bargraph
- Touch Hold
- Holster

Cat Q-1607

$399

Not on display in all stores.

Fluke 12 3.75 Digit

- Auto-Ranging
- Auto-Mode Change

Cat Q-1612

$199.95

3.75 Digit

- Auto Range
- Bar Graph Display
- Holster

Cat Q-1424

$109.50

3.5 Digit

- 18 Range
- Battery Check

Cat Q-1442

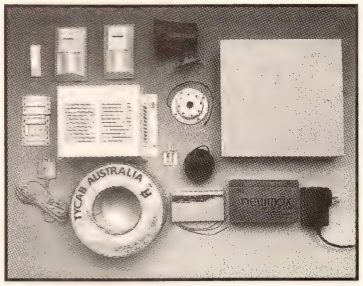
$49.95

The Complete Home Security Pack

Professional quality home security in one take-home pack! Its built-in alarm dialler makes it ideal for connection to a monitoring service. Comes with everything you need to protect your home and belongings including easy-to-read instructions that make installation a breeze.

Cat L-5720

$599



Comes with:

- Professional 6-sector controller
- Digital entry code pad
- Two passive infrared detectors
- Two magnetic reed switches
- Emergency button
- High pitched internal siren
- External horn speaker & cover
- Flashing strobe
- 100 metres of cable
- Battery & mains power plug pack
- Deterrent stickers and instructions

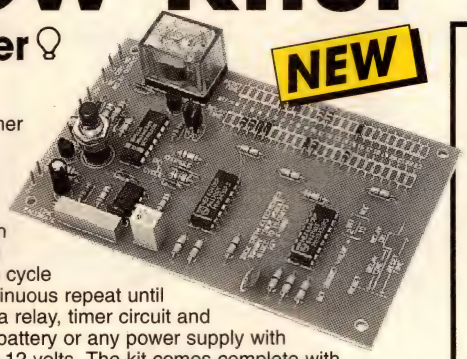
Check Our Great New Kits!

WIN!

For the chance to win an ELECTRONICS HAMPER VALUED AT $1000, hurry into your nearest store for your copy of our October Benchmark!

Multi-Timer Module

NEW



A handy low-cost timer that can be programmed for a total cycle time between 0.1 sec and 19.4 days. It can be programmed and configured for single cycle operation or for continuous repeat until reset. Consisting of a relay, timer circuit and diodes, it runs on a battery or any power supply with a voltage range of 9-12 volts. The kit comes complete with silk-screened solder-masked PCB, components and relay.

Cat K-2807

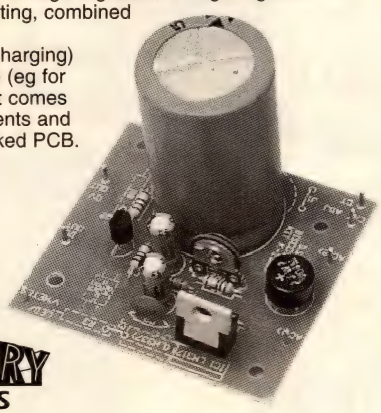
$24.95

DISCOVERY SERIES

1.2V To 37.5V/1.5A Regulated Power Supply

Based on the highly versatile LM317T three terminal voltage regulator IC, this kit performs as a general purpose regulated power supply. Attach it to 240V mains (via a transformer) or a cigarette lighter socket and use it as a battery substitute! With built-in current and overload protection, it can be configured as any one of four power supplies: Fixed or variable voltage regulator, voltage regulator with programmable current limiting, combined voltage/current limiting (eg. for lead/acid battery charging) or constant current source (eg for NiCad battery charging). It comes complete with all components and silk screened, solder masked PCB.

Cat K-2808



$16.95

EA August

DISCOVERY SERIES

LED Battery Voltage Indicator

Handy and affordable! It can be used in most battery operated equipment and combines the functions of a power-on LED and battery voltage indicator. It can be used over a range of 6 to 30 volts, employing a dual-coloured LED which glows until the battery power starts to run low, letting you know that it's time to change it. A tiny 25mm square, it fits neatly in the smallest of places. Comes complete with PCB and components.

Cat K-3118 EA September '95 **$6.95**

Vader Voice Kit

Here's one for Trekkies and Star Wars fans! It lets you disguise your voice as Darth Vader's (Star Wars) and Cylon's (Star Trek)! The main unit is housed in a small zippy box complete with volume, effect rate adjustment and on/off controls, while the microphone is connected via shielded cable. Easy to assemble, the kit comes complete with all components, PCB, hardware, case, speaker and front panel label.

Cat K-3511

SILICON CHIP September '95 **$29.95**

Surround Sound Decoder

Provides superb surround sound at a great low price! By employing low distortion analogue circuitry and subjecting the audio signals to as little processing as possible, this kit performs as a very effective and easy-to-use decoder. Unlike the previous decoder featured in Electronics Australia (January 1992), it uses op-amps, operating on the signals at line-level before the power amplifiers. The kit comes supplied with all components, hardware, PCB, pre-punched silk-screened front panel and deluxe plastic case.

Cat K-5406

$69.95

EA May '95

Availability: Our kits consist of many different parts from numerous suppliers. Whilst we have consulted closely with them and are satisfied with their ability to supply, sometimes problems can arise in obtaining all of the parts. This means there is a slight chance that availability may be delayed. Rainchecks are available, however, if you'd like to check beforehand, don't hesitate to contact your local store.

MAJOR DICK SMITH ELECTRONICS AUTHORISED STOCKISTS:

NSW: BATEMAN'S BAY: **725 030** •BATHURST: **323 933** •BOWRAL: **611 861** •BROKEN HILL: **884 098** •COOTAMUNDRA: **422 561** •DENILIQUIN: **813 672** •DUBBO: **828 711** •GOULBURN: **221 288** •GRAFTON: **421 911** •GRIFFITH: **624 534** •KEMPSEY: **631 134** •LEETON: **532 800** •MOREE: **522 091** •MUDGEE: **723 895** •MURWILLUMBAH: **723 684** •PARKES: **623 366** •RICHMOND: **784 101** •TUNCURRY: **545 006** •WINDSOR: **776 722** •YOUNG: **821 279 VIC:** •ARARAT: **522 345** •BAIRNSDALE: **525 677** •BENALLA: **622 710** •COLAC: **312 847** •ECHUCA: **822 956** •HAMILTON: **72 2865** •HORSHAM: **824 680** •MORWELL: **339 458** •ROSEBUD: **822 225** •SHEPPARTON: **219 497** •SWAN HILL: **329 303** •WARRAGUL: **234 255** •WARRNAMBOOL: **615 111** •WONTHAGGI: **721 411 QLD:**:AYR: **831 566** •BOONAH: **(0754) 632 606** •BUNDABERG: **521 785** •CALOUNDRA: **(0754) 918 533** •GYMPIE: **(0754) 836 677** •INGHAM: **763 188** •INNISFAIL: **612 014** •KINGAROY: **625 777** •MACKAY: **511 723** •MARYBOROUGH: **214 559** •MOSSMAN: **982 200** •MT. ISA: **433 475** •PIALBA: **283 749 TAS:** BURNIE: **319 222** •DEVONPORT: **248 322 SA:** WHYALLA: **454 764 WA:** ALBANY: 412 077 •BUNBURY: **216 222** •BUSSELTON: **542 991** •GERALDTON: **211 278** •MANDURAH: **581 4940** •MARGARET RIVER: **573 888** **Stores Across Australia & New Zealand**

See Us For The Best Value In Town!

Electronics For Model Railways

Exciting additions to the easy-to-follow Talking Electronics range of books, these volumes contain instructions on how to build innovative projects for model railways.

Book 1
Cat B-3641
$3.50

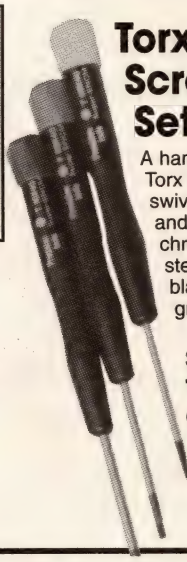
Book 2
(Not Illustrated)
Cat B-3642
$3.80

Security Torx Screwdrivers

Quality Crescent brand security Torx screwdrivers to suit the growing number of devices that use security Torx screws, including computer power supplies, fax machines, and power tools. Made in Australia.

Size	Cat No.
T8	T-6134
T10	T-6135
T15	T-6136

$14.95 each

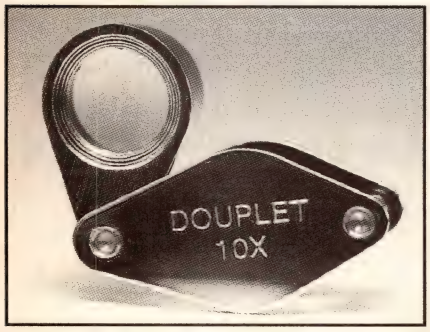


Torx Screwdriver Set

A handy set of 3 small Torx screwdrivers with swivel-headed caps and tough nickel chrome molybdenum steel shafts, plus black oxided tips for greater durability.

Sizes T6,T8, T10.
Cat T-6138

$16.95

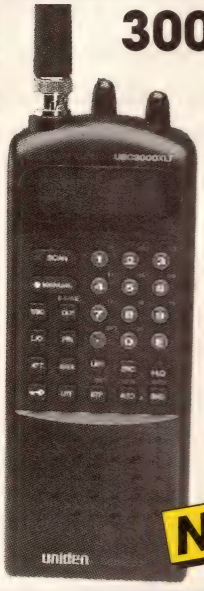


Pocket Magnifier

Ideal for checking surface mount components, cracks in PCB tracks, or the quality of solder joints, this well-made pocket magnifier provides 10 x magnification, and slides back into its plated brass case for protection after use.

Cat T-4595 **$16.95**

3000XLT Scanning Receiver



The new Twin-Turbo 3000XLT scanner provides wide 16-band frequency coverage (25-549.95MHz, 760-1300MHz), a large back-lit LCD screen, 400 memories divided into 20 banks for easier scanning, together with super-fast Scan and Search functions (scan up to 100 channels/sec, search at 100 or 300 steps/sec). An Auto battery save circuit prolongs battery life while on standby, while Data Skip and Lock Out functions allow for faster scanning. Other features include Auto Sort for faster bank scanning, 10 priority channels, selectable Search step sizes (5, 12.5, 25, 50kHz; and 30kHz on 800MHz), Scan/Search delays, battery-free memory back-up, and an Attenuator to reduce overload from very strong signals. Complete with NiCad battery pack, AC charger, flexible antenna, carry case, and detailed instructions.

Sensitivity -	**0.3 - 0.5uV N.FM**
(nom. 12dB SINAD)	**1.2 - 2.5uV W.FM**
	0.4uV AM
Size -	**69 x 39 x 187mm (W x D x H)**

Cat D-2730

NEW $599 **uniden.**

DICK SMITH ELECTRONICS

This magazine is now on sale at all of our New Zealand stores!

PHONE, FAX & MAILORDER SERVICE

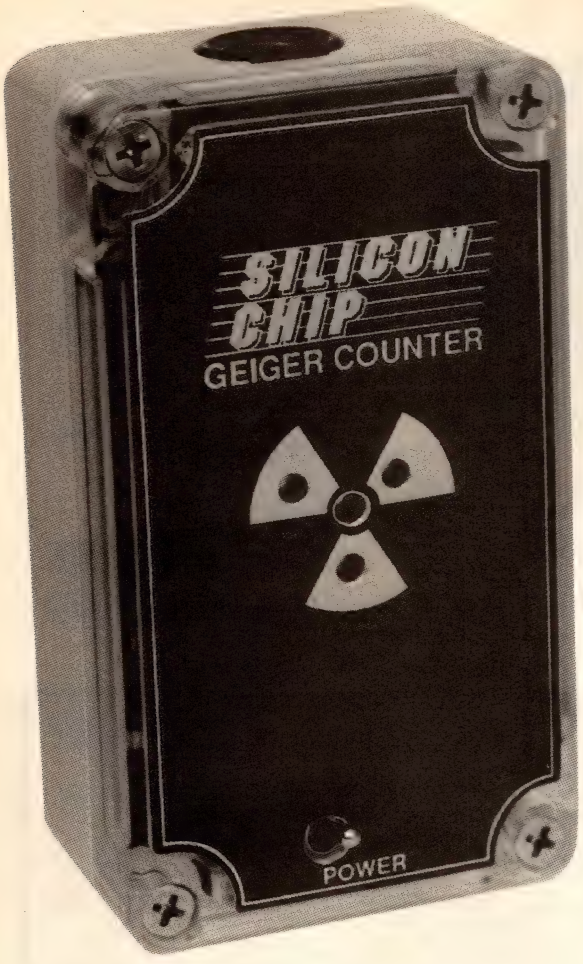
AUSTRALIA: Outside Sydney: FREE Call (1800) 263 922
Sydney and Enquiries - (02) 937 3366
Fax: (02) 805 1986 or write to
Dick Smith Electronics, Mail Orders, Reply Paid 160
PO Box 321 NORTH RYDE NSW 2113

NEW ZEALAND: Phone: (09) 480 8049 or (09) 480 3331
Fax: (0800) 800 290 or write to
Dick Smith Electronics, Mail Orders Division, Private Bag 102-903
North Shore Mail Centre, Auckland
All major Credit Cards accepted. Overnight Courier Available.

NSW • Albury **21 8399** • Bankstown Square **707 4888** • Blacktown **671 7722** • Bondi **387 1444** • Brookvale **9905 0441** • Burwood **744 7299** • Campbelltown **27 2199** • Chatswood **411 1955** • Chullora **642 8922** • Gore Hill **439 5311** • Gosford **25 0235** • Hornsby **477 6633** • Hurstville **580 8622** • Kotara **56 2092** • Liverpool **600 9888** • Maitland **33 7866** • Miranda **525 2722** • Newcastle **61 1896** • North Ryde **9937 3355** • North Sydney (Greenwood Plaza) **9964 9468** • Orange **618 400** • Parramatta **689 2188** • Penrith **(047) 32 3400** • Railway Square **211 3777** • Sydney City York St **267 9111** & Mid City Centre **221 0000** • Tamworth **66 1711** • Wollongong **28 3800 ACT** • Belconnen **(06) 253 1785** • Fyshwick **280 4944 VIC** • Ballarat **31 5433** • Bendigo **43 0388** • Box Hill **9890 0699** • Coburg **9383 4455** • Dandenong **9794 9377** • East Brighton **9592 2366** • Essendon **9379 7444** • Frankston **9783 9144** • Geelong **232 711** • Highpoint **9318 6300** • Melbourne City 399 Elizabeth St **9326 6088** & 246 Bourke St **9639 0396** • Richmond **9428 1614** • Ringwood **9879 5338** • Springvale **9547 0522 QLD** • Alderley **3356 3733** • Booval **3282 6200** • Brisbane City **3229 9377** • Buranda **3391 6233** • Cairns **311 515** • Capalaba **3245 2870** • Chermside **3359 6255** • Indooroopilly **3878 4944** • Maroochydore **791 800** • Mermaid Beach **5578 5600** • Rockhampton **27 9644** • Southport **5532 9863** • Toowoomba **38 4300** • Townsville **72 5722** • Underwood **3341 0844 SA** • Adelaide City Pulteney St **232 1200** & Myer Centre **231 7775** • Elizabeth **255 6099** • Enfield **260 6088** • St Marys **277 8977** • Westlakes **235 1244 WA** • Balcatta **240 1911** • Cannington **451 8666** • Fremantle **335 9733** • Perth City **481 3261** • Midland **250 1460** • Northbridge **328 6944 TAS** • Glenorchy **732 176** • Hobart **31 0800** • Launceston **344 555 NT** • Darwin **81 1977**

*** STORES UNDERLINED ARE OPEN SUNDAYS.** **STORES ACROSS AUSTRALIA AND NEW ZEALAND**

B 2103



Monitor radioactivity with this compact GEIGER COUNTER

Are you are concerned by the Nuclear tests in the Pacific and in China? Worried about a possible increase in the amount of background radiation? Then check it out with this Geiger counter. It will detect alpha, beta and gamma radiation and has an audible output.

By JOHN CLARKE

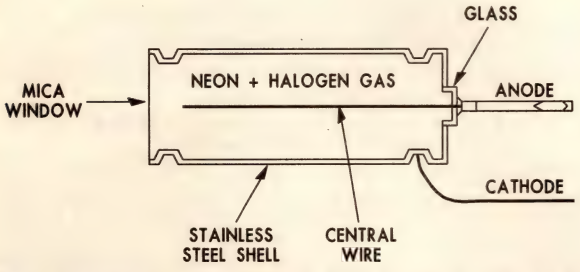
Most people have never used a Geiger counter but they would probably have seen them in old war movies. These showed people in full protective suits sweeping an area with a rather large "high tech" contraption that produced loud clicking when a source of radiation was detected. Our Geiger counter does the same job and produces audible clicks at a rate dependent on the amount of radioactivity. However, it is much more compact and does not require the obligatory carry handle used on the instruments of the past.

What is radioactivity?

Radioactivity is the emission of energy or particles due to the spontaneous decay of an unstable nucleus of an element to a lower energy state.

Atoms of all elements have a nucleus comprising one or more protons and neutrons plus outer shells of electrons. The number of protons in the nucleus is referred to as the Atomic Number and this determines the basic element properties. While most atoms of an element will have a fixed number of neutrons, some can differ and these are called isotopes. Most isotopes are unstable and all isotopes above Bismuth (Bi) with an Atomic Number of 83 are unstable.

An unstable isotope will spontaneously decompose and emit radioactive energy which is far greater than the energy changes normally associated with chemical reactions. Radio-



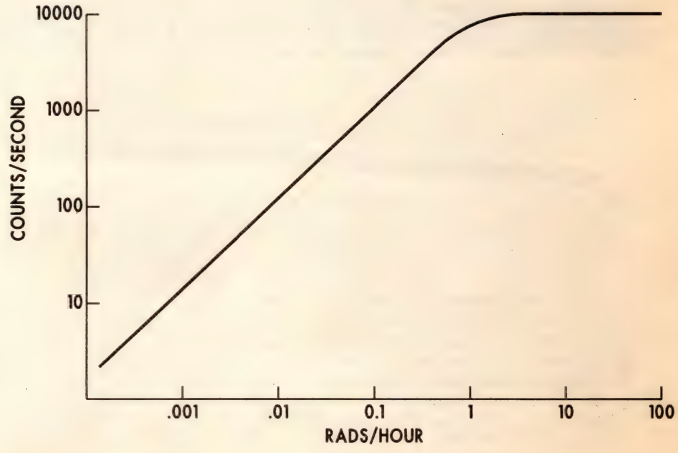


Fig.1 (above): cross section of the Geiger Muller tube. The passage of an alpha or beta particle or a gamma photon causes the tube gas to ionise and produces a brief discharge. Fig.2 at right shows the response characteristic of the Geiger tube to radiation. It is limited by the tube "dead time" to about 10,000 counts/second.

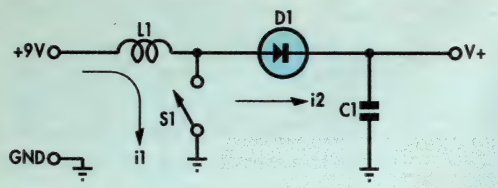


Fig.3: the basic circuit of a DC-DC boost converter. Each time S1 opens, the energy stored in L1 is dumped into C1.

Table 1: Radiation Effects	
Dose (Rems)	**Effect**
0-25	Nil
25-50	White blood cell count reduced slightly
50-100	High reduction in white blood cell count
100-200	Nausea, hair loss
200-500	Bleeding, likelihood of death
above 500	Fatal

activity comprises alpha particles, beta particles, gamma rays, fast neutrons, positrons, photons or a combination of these.

Alpha particles are positively charged particles which are identical to Helium nuclei; ie, they comprise two protons and two neutrons. These particles can cause a large amount of tissue damage but fortunately they do not travel very far in air. In fact, alpha particles must have an energy of greater than 6MeV before they can travel 45mm. MeV stands for million electron volts and is a measure of the energy of the particle.

As an example, the Americium alpha particle source used in most smoke detectors only has a range of 20mm or so before all the particles are stopped by collisions with the air. The alpha particles are further restricted by the fine particles of smoke and this is the principle of operation of smoke detectors. We'll talk a little more about smoke detectors later but readers should note that provided a smoke detector is not disassembled it emits no alpha particles at all; they are all confined within the metal chamber.

Beta particles are electrons. Electrons with energies over 1MeV lose a lot of energy by producing continuous X-rays.

Gamma rays are high energy photons (electromagnetic waves) with a very short wavelength (.0005nm to 0.1nm). These photons are difficult to stop unless very thick lead or concrete barriers are placed in their path.

The Positron is a positively charged particle with the same mass as an electron.

Biological effect

The total biological effect of radiation is measured in rems which stands for "Roentgen Equivalent in Man". This is found by multiplying the number of rads (absorption of .01 joules per kilogram of tissue) by a factor of 1 for beta, gamma and X-radiation and by 10 for alpha and other high-energy neutron sources. Table 1 shows the effects of radiation at varying exposures, measured in rems.

Geiger counter circuit

The heart of a Geiger counter is a Geiger Muller tube which is essentially an ionisation detector. Its cross section is shown in Fig.1. It comprises a metal case with a mica window at one end and a glass insulating seal at the other. A thin wire is located in the centre of the case and a high voltage of around 500V is applied between this (Anode) and the metal case (Cathode). When a radiation particle or photon enters the tube via the mica window, it ionises the gas and this creates a discharge.

After each discharge, the tube is not

WARNING!

This circuit includes a 500V supply which can cause an electric shock. Avoid contact with the circuit components when power is on.

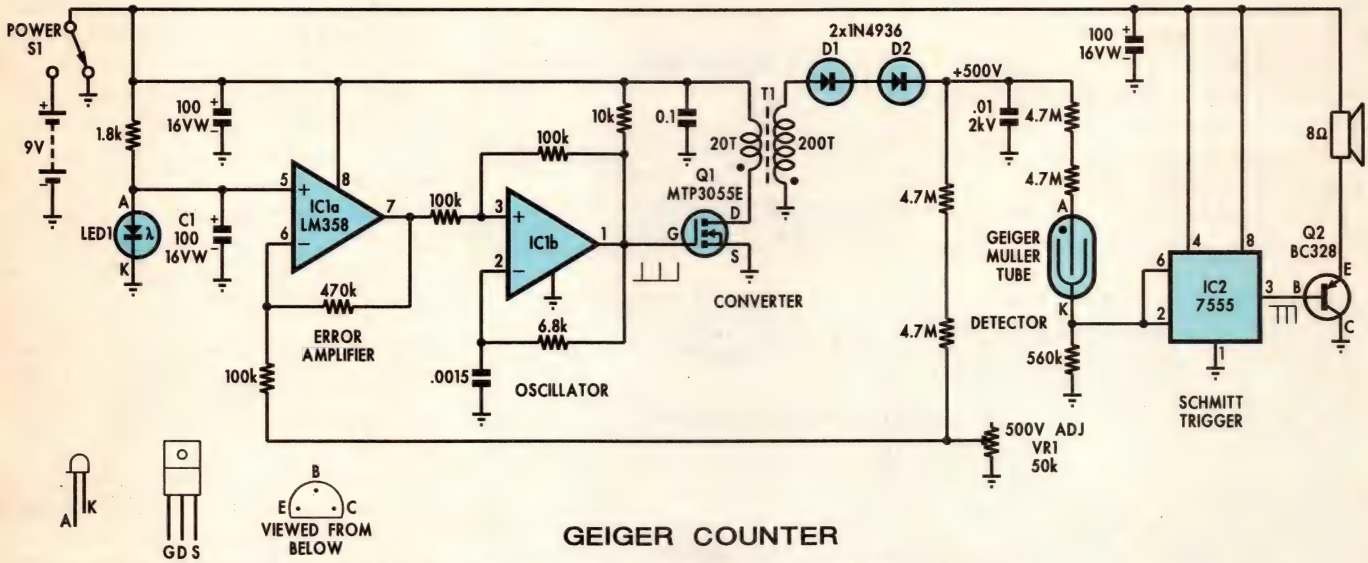
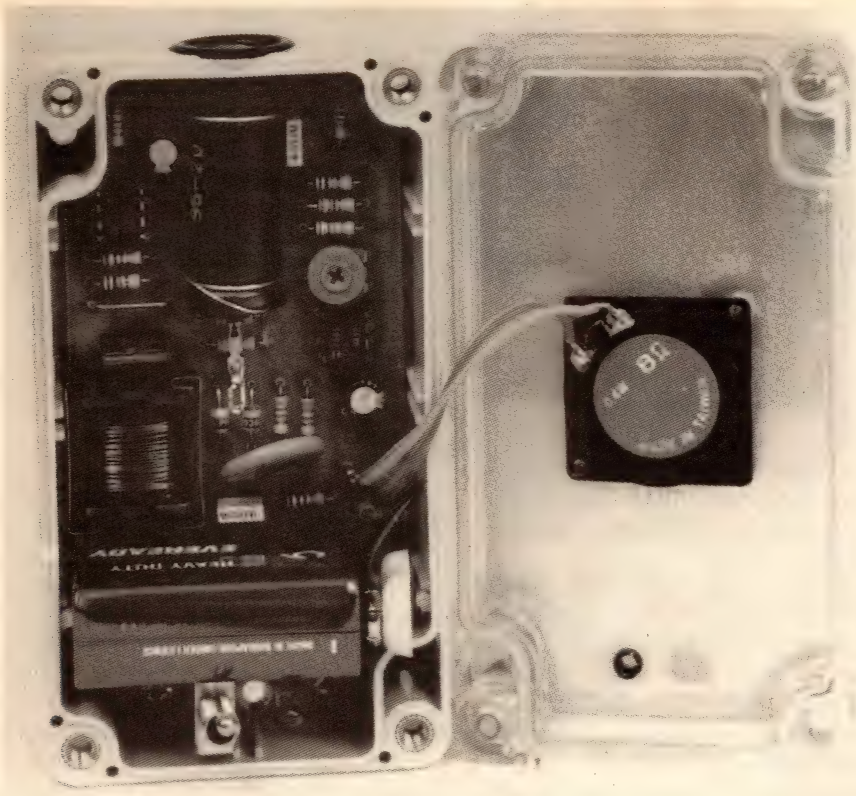


Fig.4 (below): the full circuit of the Geiger Counter. IC1 and Q1 step up the battery voltage to 500V DC for the Geiger tube. Each time the tube discharges due to the passage of a radioactive particle or photon, IC2 and Q2 produce a click in the loudspeaker.



Inside the case of the Geiger counter. Note that the corners of the PC board must be filed to fit it into the case. The 9V battery sits on top of a small foam cushion and is held in place when the lid of the case is attached.

immediately sensitive to further ionising radiation until the gases have reverted to their normal de-ionised state. This period of insensitivity is called dead time and it sets a limit on the number of discharges per second. In the Geiger Muller tube used in our circuit, the dead time is typically 90 microseconds and this limits the maximum number of detectable discharges to about 10,000 per second.

Fig.2 shows the radiation response of the tube. The horizontal axis shows the level of radiation while the vertical axis shows the number of discharges per second.

Note that radiation sources are typically random in nature, so the audible output from the Geiger counter is just noise. At low radiation levels, it produces random clicks and as the radiation level is increased, the clicks become more rapid but still quite random. At much higher radiation levels, the clicks merge into noise with a rather "spitty" quality.

Table 2: Typical Radiation Exposure

Natural Sources (Millrems/Year)	
Cosmic	50
Earth	47
Buildings	3
Air	5
Internal human tissue (potassium isotopes)	21
Man-Made Sources (Millrems/Year)	
X-ray machines	50
Radioisotopes	10
Luminous watch dials, TV tubes	2
Radioactive fallout during nuclear tests	4-30

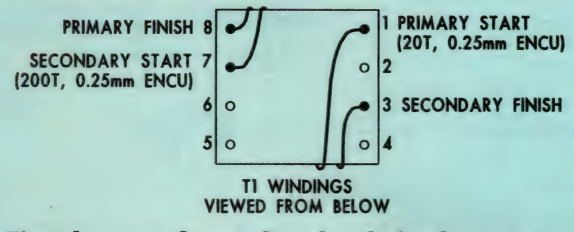


Fig.5: here are the winding details for the step-up transformer. Note that the two windings are both wound in the same direction.

The Geiger Muller tube requires a high voltage supply of around 500V DC. To provide this we step up the supply from a 9V battery. Fig.3 shows how this is done using a boost converter.

Initially, S1 is closed and current builds up in inductor L1. The inductor current is i_1. When S1 is opened, inductor current i_2 passes via diode D1 to charge capacitor C1. The actual voltage developed depends on the inductance of L1, the length of time that L1 is charged (ie, for the current to build up) and the load current drawn from C1. By the use of a feedback circuit, the voltage across C1 can be set to the required level.

Now refer to the full circuit for the Geiger counter in Fig.4. The step-up arrangement differs from that in Fig.3 in that the inductor is a transformer with two windings and a Mosfet transistor (Q1) is used as the switch. The advantage of using a transformer with a higher voltage secondary is that we can use a readily available 60V Mosfet rather than a more expensive 600V type.

Q1 is switched on and off at a rate of about 10kHz by op amp IC1b which is connected as a Schmitt trigger oscillator. IC1b operates by successively charging and discharging the .0015µF capacitor at its pin 2 via the 6.8kΩ resistor from its output at pin 1.

Each time Q1 switches off, it produces a high voltage (ie, many times the 9V supply) pulse across the primary of transformer T1. The transformer steps up the primary pulses by a factor of 10 in its secondary and the resultant output is fed via diodes D1 & D2 to a .01µF 2kV capacitor.

Regulating the output

While the circuit described so far will certainly develop a high DC output, the actual voltage will tend to vary widely, depending on the input DC voltage and the load current drawn by the Geiger Muller tube which will itself vary widely, depending on the amount of radiation present. To set the DC output close to 500V we need

a negative feedback circuit and this is provided by op amp IC1a which functions as an error amplifier.

IC1a monitors the DC output of the boost converter via a voltage divider consisting of two 4.7MΩ resistors in series, trimpot VR1 and the 100kΩ resistor to pin 6. IC1a compares the DC voltage at its pin 6 with the reference voltage at its pin 5, provided by the 1.8V voltage drop across light emitting diode LED1. IC1a amplifies the difference between the two and its output is used to vary the threshold voltage of the Schmitt trigger oscillator, at pin 3 of IC1b.

Hence, if the DC output voltage is higher than it should be, IC1a increases the voltage at pin 3 and the result is that the pulses fed to Q1 are slightly reduced. This reduces the output voltage. Conversely, if the DC output voltage is a little low, due to extra drain or a lower battery voltage, IC1a lowers the threshold voltage at pin 3, lengthening the pules to Q1 and thereby increasing the output voltage to what it should be.

C1, the 100µF 16VW capacitor across LED1, is there to prevent overshoot of the high voltage DC at switch-on.

Two fast recovery diodes, D1 & D2, have been used in series at the secondary of T1 because the breakdown voltage for each diode is only 500V. By using two diodes in series we get an adequate safety margin. Normally though, to ensure equal voltage sharing, the diodes should each have a high voltage resistor (eg, 1MΩ) across them. However, in this circuit, the impedances are so high that we are relying on the internal leakage of the diodes to provide adequate voltage sharing.

The 500V supply is applied to the Geiger Muller tube via two 4.7MΩ resistors in series. When the tube detects radiation, its impedance drops sharply and a brief pulse appears across the 560kΩ cathode resistor. This pulse is fed to IC2, a 7555 wired as a Schmitt trigger. It can be thought of as a pulse buffer, between the high impedance of the 560kΩ cathode resistor and the low impedance of the base of transistor Q2.

Thus each time the Geiger tube discharges, IC2 delivers a brief pulse to Q2 which drives the loudspeaker to produce an audible click.

Power for the circuit comes from a 9V battery via switch S1. When the switch is off it connects the circuit's positive supply rail directly to the 0V rail. This discharges C1, the capacitor across LED1, so that the circuit will start slowly when power is reapplied.

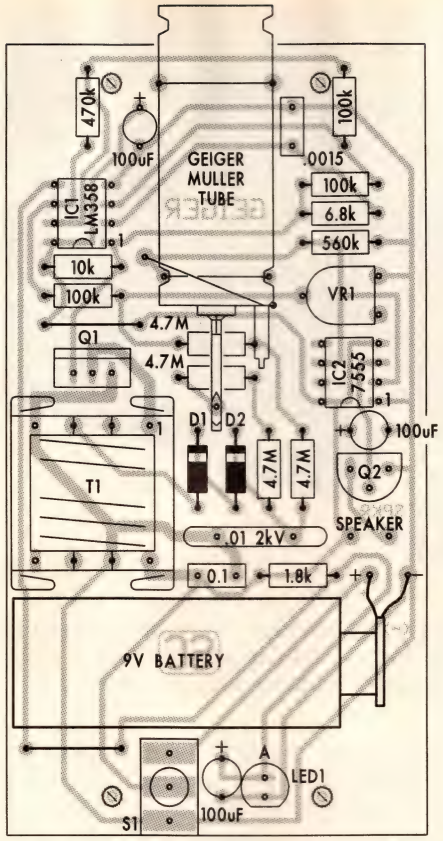


Fig.6: follow this component layout diagram when installing the parts on the PC board. The Geiger Muller tube is held in place with wire straps.

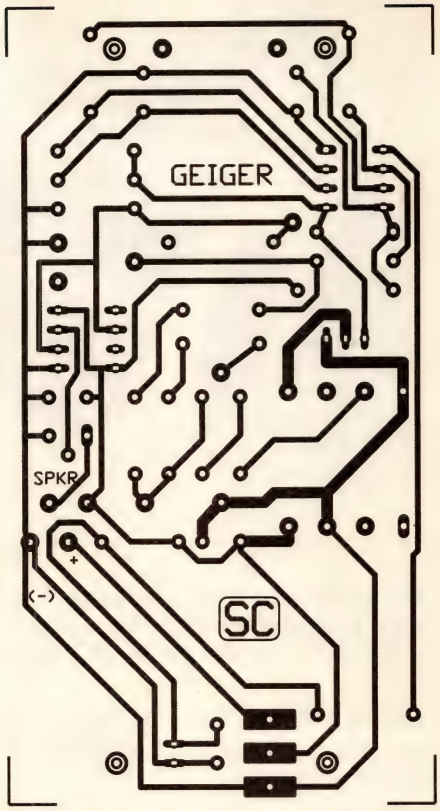


Fig.7: this is the full size etching pattern for the PC board. Check your board carefully before mounting any of the parts.

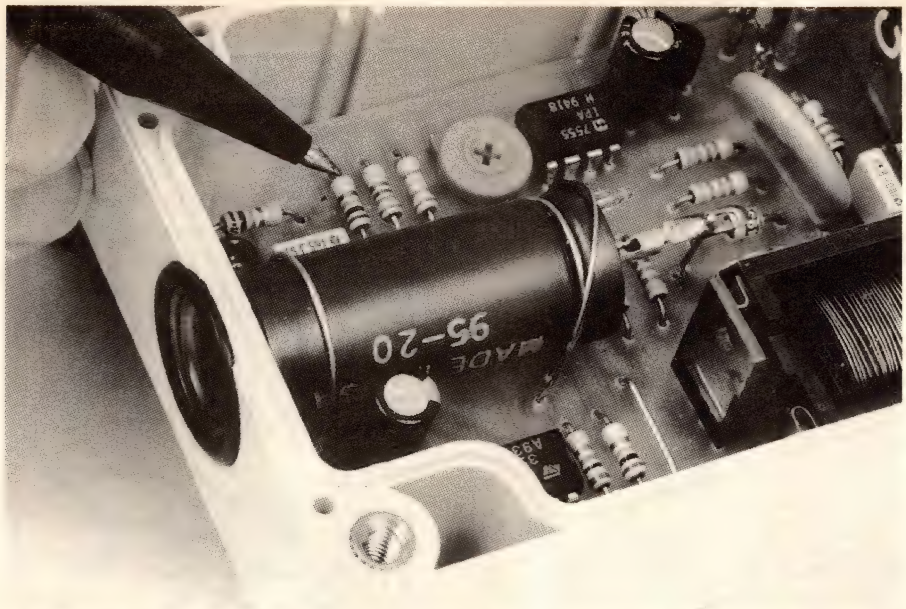
Assembly

All the components are mounted on a PC board coded 04310951 and measuring 56 x 104mm. The component overlay is shown in Fig.6.

Begin construction by checking the PC board for any breaks or shorts between tracks. Also the corners of the PC board will need filing so that it

TABLE 3: RESISTOR COLOUR CODES

❑	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	4	4.7MΩ	yellow violet green brown	yellow violet black yellow brown
❑	1	560kΩ	green blue yellow brown	green blue black orange brown
❑	1	470kΩ	yellow violet yellow brown	yellow violet black orange brown
❑	3	100kΩ	brown black yellow brown	brown black black orange brown
❑	1	10kΩ	brown black orange brown	brown black black red brown
❑	1	6.8kΩ	blue grey red brown	blue grey black brown brown
❑	1	1.8kΩ	brown grey red brown	brown grey black brown brown



The Geiger tube is secured to the PC board with a couple of wire straps over the body, as shown here. The third wire at the end of the tube is the cathode connection. Note the use of "O" rings at the mica window end of the tube.

will fit into the case. The required shape is shown on the copper side of the PC board.

This done, start the board assembly by installing the PC stakes. These are located at the + and (-) battery input points and the loudspeaker outputs. Three PC stakes are also placed in the holes for switch S1 so that it will be raised from the PC board.

Next, install the two wire links (one near Q1 and the other next to S1), then install all the resistors, using Table 3 to guide you with the colour codes. This done, insert the diodes and ICs, taking care with their orientation. The capacitors are next, followed by Q1, Q2 and trimpot VR1. LED1 is mounted using the full length of its leads so that it will protrude through the front panel. It is a good idea to fit plastic sleeving over one of the leads, to prevent shorts. Switch S1 is soldered on the top of the PC stakes.

Do not attach the Geiger tube yet!

Transformer winding

Transformer T1 is wound with 0.25mm enamelled copper wire as shown in Fig.5. The secondary is wound first. Strip back the insulation on one end of the wire and terminate it on pin 7 of the bobbin. Now wind a layer of turns side by side in the direction shown and wrap a layer of insulating tape around this. Make sure that the tape does not start or finish on the sides of the former since this will prevent the cores sliding onto the bobbin when winding is completed.

Continue winding and apply one thickness of insulating tape over each layer. After 200 turns, terminate the end of the winding into pin 3.

The primary is started on pin 1 and after 20 turns finished on pin 8. It must be wound in the direction shown. There will not be sufficient room for a layer of insulating tape on this primary winding.

The transformer is assembled by sliding the cores into each side of the bobbin and securing the clips. This done, solder the transformer to the PC board, making sure that it is oriented correctly.

Circuit testing

Wind trimpot VR1 fully anticlockwise, connect the battery leads and switch on. The LED should light and the transformer should emit a high pitched whistle. **Take care not to touch the circuit because of the high voltage it produces.**

Select the 1000VDC range on your multimeter. Attach the negative lead to the (-) battery terminal on the PC board and the positive lead to the cathode (striped end) of D2. Adjust VR1 for a reading of about 500V.

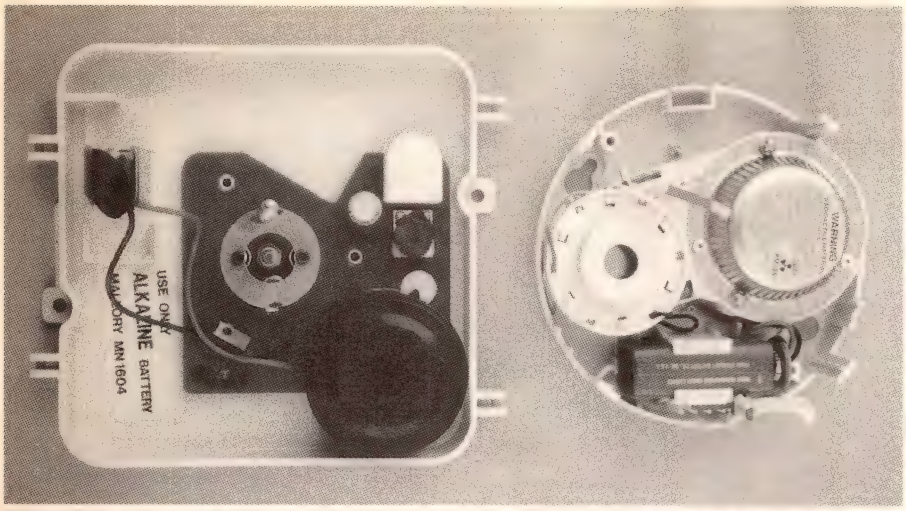
Disconnect the battery and connect the Geiger tube to the PC board. The tube is secured using tinned copper wire straps over the body, while its cathode lead is soldered to a pad adjacent to pin 1 of IC1. The anode connection is made using a short length of tinned copper wire to a pad near the cathodes of D1 & D2. Avoid using excess heat on the anode terminal when soldering.

Case

The unit is housed in a plastic case measuring 64 x 114 x 42mm. One end of the case needs a 19mm hole drilled for the Geiger tube. We used two 18mm OD "O" rings to support the tube and provide shock relief. One "O" ring is fitted over the groove at the mica window end. The other is placed over the section of the tube where it just protrudes from the end of case. The board is mounted in the case using four 3mm screws at the corners.

Tube Specifications

Gas content	Neon & halogen
Operating temperature	-40°C to +75°C
Window material	Mica
Recommended anode resistor	10MΩ
Starting voltage	325V
Recommended operating voltage	500V
Operating voltage range	450-600V
Minimum dead time	90µs
Minimum alpha particle energy for detection	2.5MeV
Minimum beta particle energy for 25% absorption in mica window	30MeV



This photo shows the internal construction of two typical smoke detectors. Both have a detection chamber with a minute amount of the radioactive isotope Americium 241. The detector on the left has the cover of the smoke chamber removed to reveal the centrally placed alpha particle source. The Geiger Counter will only detect radiation when it is brought very close to this alpha source. This is because the alpha particles will only penetrate a very short distance in air.

Fix the label onto the lid and drill holes for the switch and LED 1, plus mounting holes for the small loudspeaker. Holes are also drilled in the radiation symbol to let the sound from the loudspeaker escape.

Attach the loudspeaker with two small self-tapping screws and wire it to the PC board using the twin rainbow cable. We used a small strip of foam plastic glued to the PC board directly under the battery to prevent it rattling in the case.

Finally, assemble the case and apply power. The Geiger tube should fire once every few seconds and sound the speaker. This is the background radiation. Any radiation greater than background will provide a much faster repetition sound.

Fig.8: the full size artwork for the front panel label.

Radiation source

If you want to test your Geiger counter with a much higher intensity than background radiation, you can use the radiation source inside a smoke detector. This consists of a small amount of the radioactive isotope Americium 241 (equivalent to 0.9 microcuries). This has a half-life of 400 years so it is pretty constant over a human lifetime.

To use the Americium alpha particle source, you need to remove the internal aluminium cover from the smoke detector's PC board. This needs to be done otherwise no alpha particles escape. With the central alpha particle source exposed, bring the window of the Geiger counter close to it. Virtually nothing happens until the Geiger tube window is within 20mm of the alpha source. Then as you bring it closer, it will begin to click rapidly and then produce more and more noise with a rising pitch as you place the source as close as possible to the window. This highlights the fact that the alpha particles penetrate only very short distances in air.

After you have made the test, reassemble the smoke detector, test it and reinstall it so it can provide you with ongoing protection against fire. **SC**

PARTS LIST

1 PC board, code 04310951, 56 x 104mm
1 plastic case, 64 x 114 x 42mm
1 Dynamark label, 55 x 103mm
1 LN712 Geiger Muller tube (from Jaycar Electronics)
1 square 30mm 8Ω loudspeaker (Altronics Cat. C-0606)
1 SPDT toggle switch (S1)
1 9V battery and battery clip
1 Philips EFD20 transformer assembly (T1):
2 4312 020 4108 1 cores
1 4322 021 3522 1 former
2 4322 021 3515 1 clips
1 8-metre length of 0.25mm enamelled copper wire
1 50mm length of twin rainbow cable
1 100mm length of 0.8mm tinned copper wire
7 PC stakes
4 3mm screws
2 self-tappers for loudspeaker
2 "O" rings 15mm ID x 18mm OD
1 50kΩ horizontal trimpot (VR1)

Semiconductors

1 LM358 dual op amp (IC1)
1 7555, TLC555, LMC555CN CMOS timer (IC2)
1 MTP3055E N-channel Mosfet (Q1)
1 BC328, BC327 PNP transistor (Q2)
1 3mm red LED (LED1)
2 1N4936 fast recovery diodes (D1,D2)

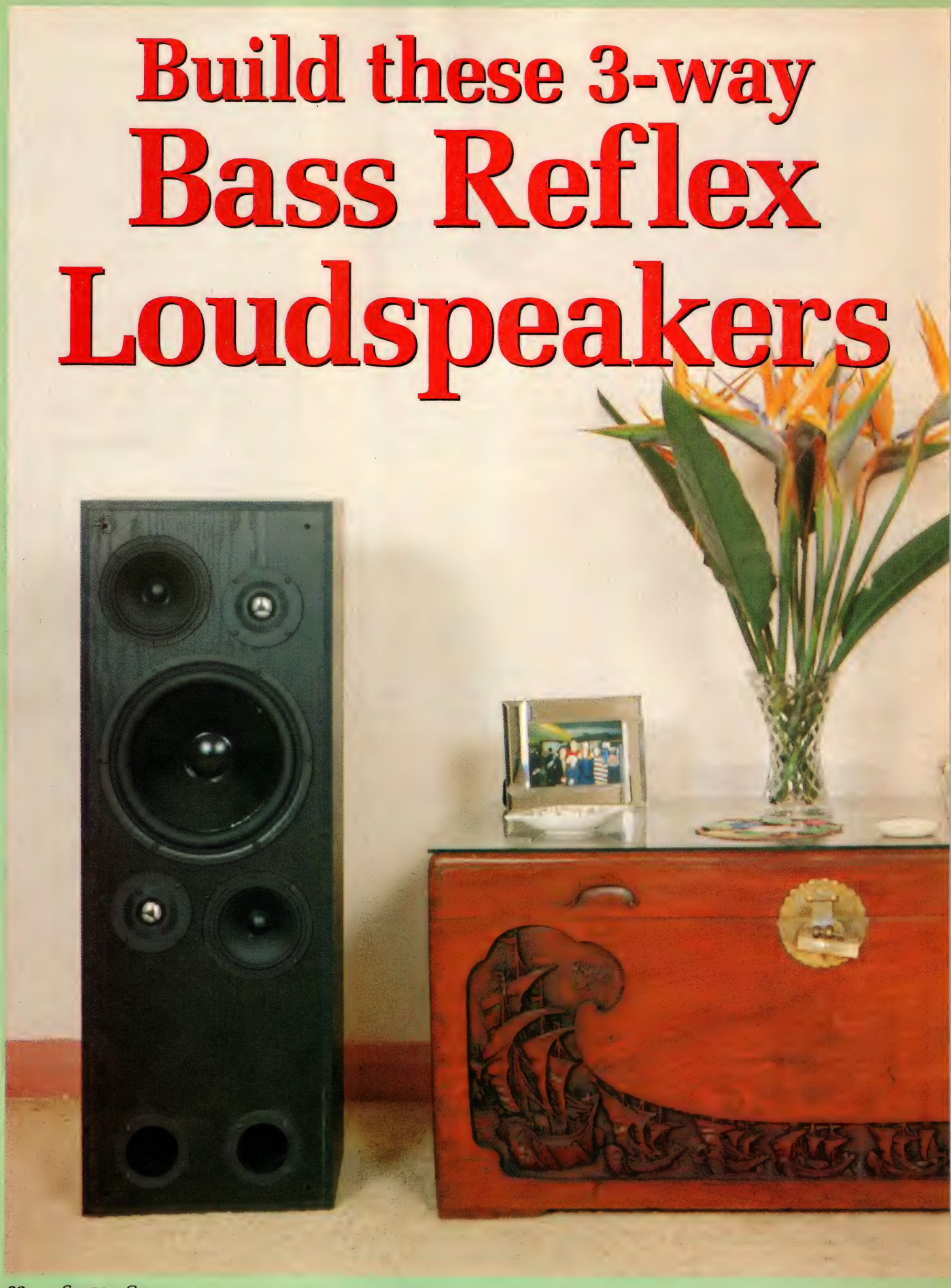
Capacitors

3 100µF 16VW PC electrolytic
1 0.1µF MKT polyester
1 .01µF 2kV ceramic
1 .0015µF MKT polyester

Resistors (0.25W 1%)

4 4.7MΩ
1 560kΩ
1 470kΩ
3 100kΩ
1 10kΩ
1 6.8kΩ
1 1.8kΩ

Build these 3-way Bass Reflex Loudspeakers



Here is the loudspeaker for those who don't want to be bothered with small unobtrusive boxes. This is a large tower design which can't be hidden. You'll need a large room for a pair of these speakers but the reward will be really great sound and lots of power handling, with a 10-inch driver providing the bass reproduction.

By LEO SIMPSON

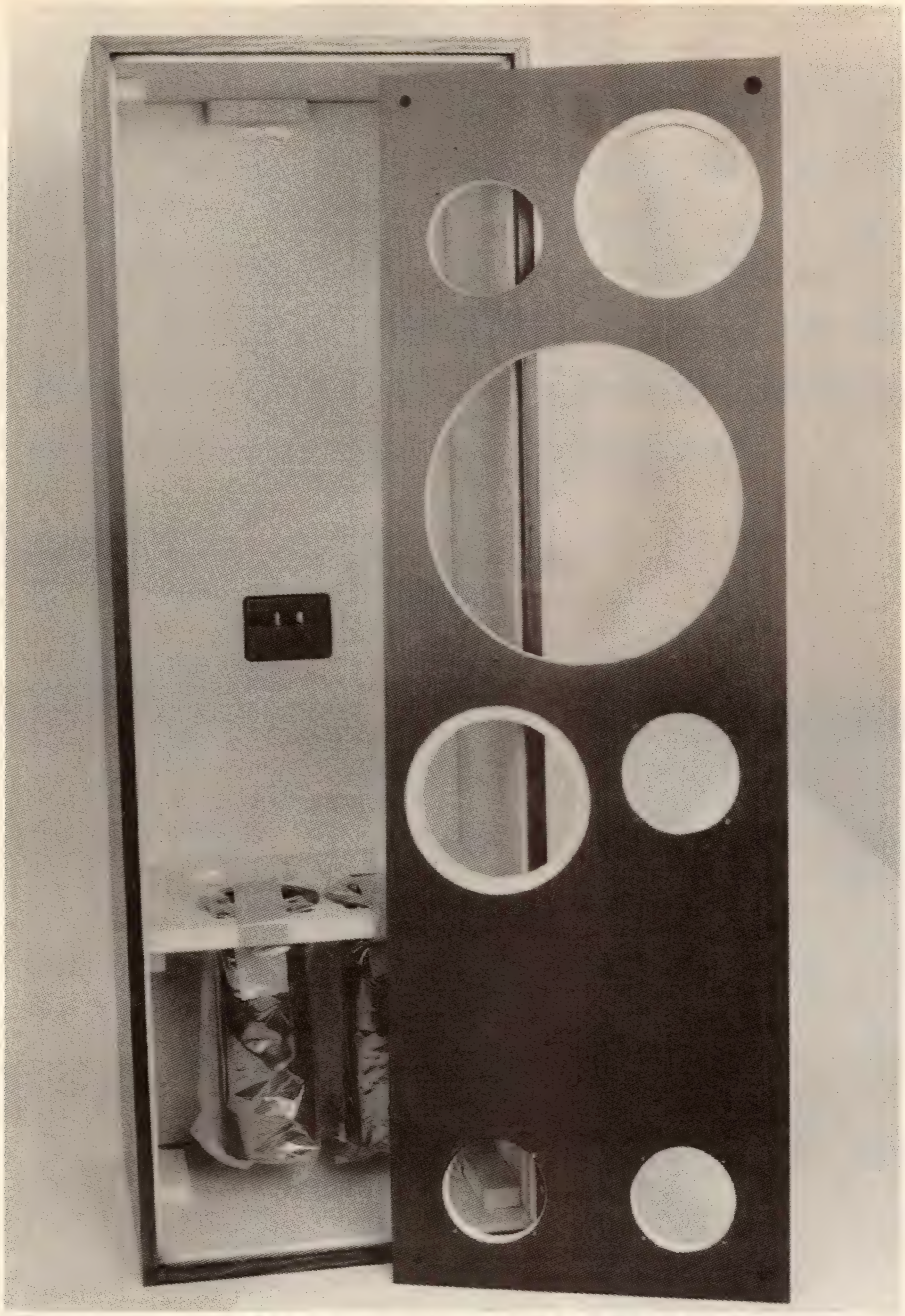
FOR THE POWER HUNGRY audio enthusiast, a 10-inch woofer in a large cabinet is equivalent to a thumping great V8 to a lead-footed petrol head. This speaker really performs, with prodigious power handling and beautiful bass down to below 30Hz.

But as well as power handling and extended bass response, this system is very satisfying in its handling of all types of music, with a smooth midrange and very clean treble reproduction.

Lest you become overly concerned about how much space is taken up by two of these cabinets, they actually take up no more floor space than typical compact two-way loudspeakers mounted on stands. They are big but they are only marginally larger than the JV60 design we featured in the August 1995 issue. The dimensions are 320mm wide, 920mm high and 315mm deep, including the thickness of the grille cloth frame. The cabinets are made of 16mm veneered particle board, internally braced and with an enclosure volume of about 64 litres.

As with the JV60's previously featured, this design was produced exclusively for Jaycar Electronics by Australian Audio Consultants, PO Box 11, Southport, SA 5410.

This is a 3-way design, featuring two ferrofluid-cooled tweeters, the same as the single tweeter in the JV60, together with two midrange drivers and a 10-inch woofer. The full circuit is shown in Fig.1. It shows a conven-



When you unpack the boxes, each enclosure will look like this. The moulded port tubes are hanging in the enclosure bracing panel. They need to be removed, the baffle glued in place and then the speakers can be installed. Not shown is the grille cloth frame which is supplied in finished form.

tional 3-way crossover network with attenuation slopes of 12dB/octave. Note that the treble, midrange and bass filter networks each have Polyswitch PTC thermistors, giving comprehensive protection against overdrive.

Normally, these Polyswitch PTC thermistors have a very low resistance and therefore have a minimum effect on the signal fed to the drivers. However, when the signal current exceeds a critical threshold, the Polyswitch suddenly goes virtually open circuit and thus prevents the loudspeaker from overdrive. After a short period which depends on the initial overload, they revert to their low resistance state and the signal is once again connected to the drivers.

As noted in the JV60 article, Polyswitches are there solely to provide insurance against overdrive or as far as the woofer is concerned, against catastrophic DC faults in the power amplifier. The speakers should not be repeatedly over-driven otherwise the performance of the Polyswitches will be prejudiced.

Two Vifa D25AG-35-06 tweeters are connected in series to cover the treble range above 3kHz, as determined by L1 and C1. Two Vifa P13WG-00-08 drivers cover the midrange frequencies from 500Hz to 3kHz, as set by L2, C2 and L3. R1 & C3 provide impedance equalisation for the midrange drivers so that they present a more "resistive" impedance to the filter components and thus ensure that steeper attenuation slopes are achieved.

A single Vifa M26WR 10-inch woofer is used for the bass frequencies and it is coupled via L4 and C4. Again, impedance equalisation is provided by R2 and C5. Nominal impedance for the complete system is 8Ω. The overall impedance characteristic is shown in Fig.3. This shows the classic double hump of a bass reflex design, with the minimum impedance of 7Ω occurring at about 120Hz.

10-inch woofer

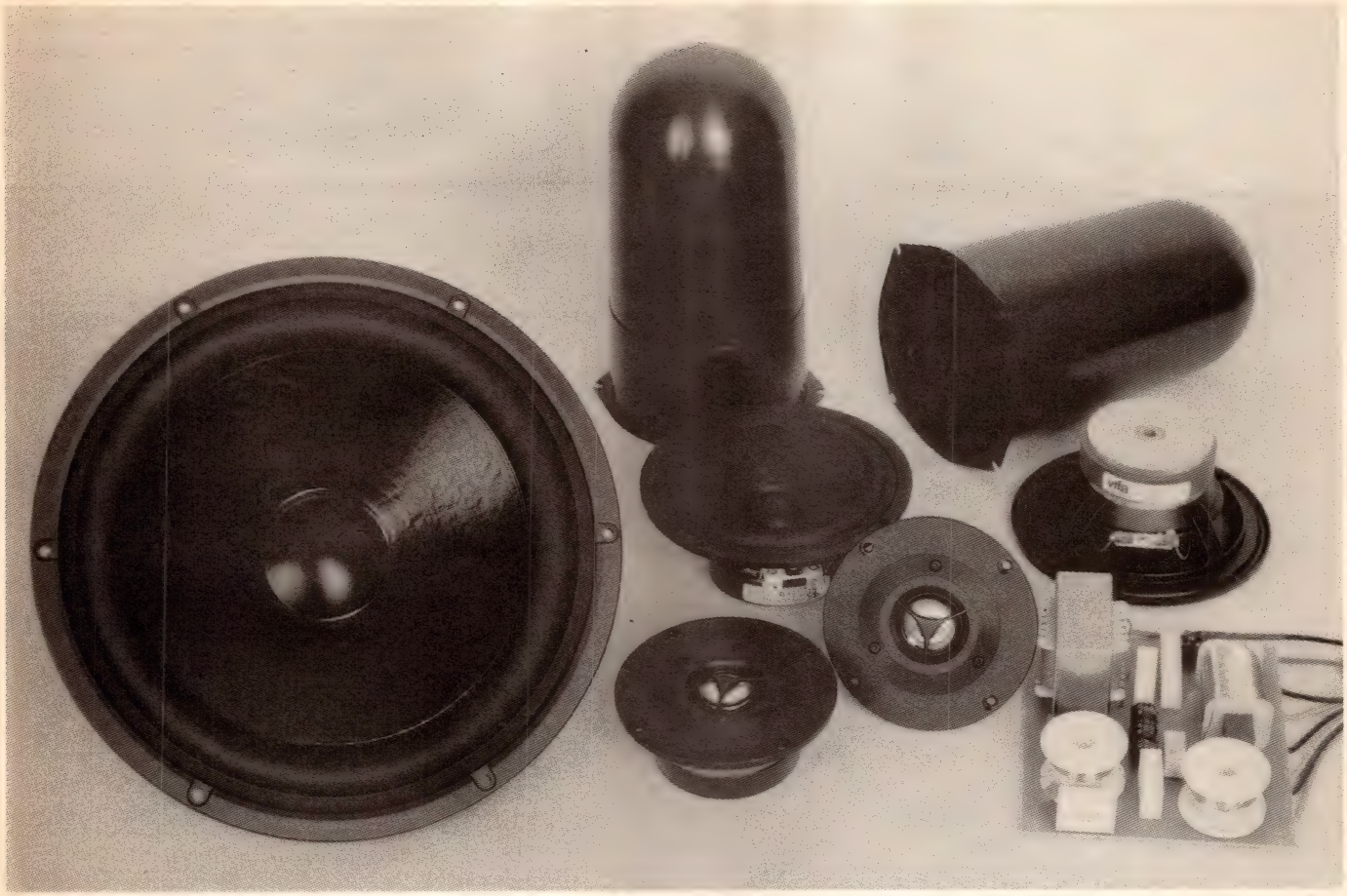
The heart of this design is the Vifa woofer. It has a large cast magnesium basket and the very stiff paper cone has a synthetic rubber roll surround. The voice coil diameter is 50mm and the effective cone area is 337 square centimetres. The free-air cone resonance is at 26Hz and the frequency coverage is up to 1kHz. Its sensitivity is 88.5dB and nominal power handling is 160 watts. Peak power handling is an impressive 500 watts.

The 64-litre enclosure has two 66mm plastic ports 200mm long. The two midrange drivers are housed in their own sealed plastic enclosures which stop their cones from being pumped back and forth by the woofer.

One of the big attractions in building this kit is that there is virtually no carpentry required. The pair of cabinets is supplied finished except for the front baffle which has to be glued into place. If you want to build your own cabinets, that is certainly an option and we have given full construction details in the diagram of Fig.2. Note that you can vary the cabinet dimensions slightly if you wish but the enclosure volume must still be close to the 64 litres.

Assembly

Assuming that you have acquired the complete kit, the first step in the



These are the Vifa drivers, crossover network and plastic midrange enclosures provided for each speaker system. Also included are the rear terminal panel, Innerbond filling and mounting screws.

assembly is to glue the baffles into each speaker box. We found that our sample cabinets had become slightly out of square while in transit and so they had to be carefully pushed back square while the baffles were pushed into place. PVA glue is supplied as part of the kit and it should be run all around the rebate for the baffle before it is pushed into place. Wipe any excess glue off the front of the baffle before it dries otherwise it will be difficult to remove.

Allow a good half hour or more for the glue to dry. Then the two bass reflex ports can be screwed into place. The next task is to mount the crossover network board onto the rear panel (inside the enclosure, of course). Before you do that, identify all the wires for the various drivers; their various colours are marked on Fig.1. Mount the crossover with four screws and terminate the two wires to the rear

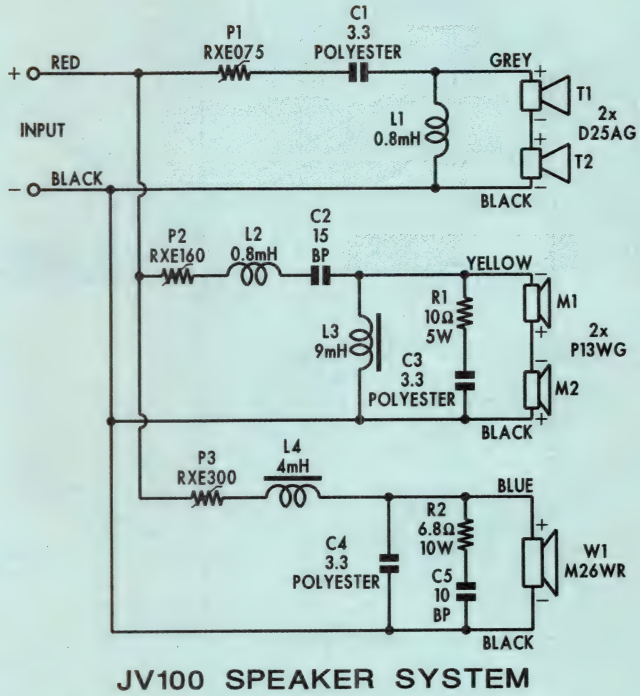


Fig.1: the JV100 is a 3-way bass reflex system with the tweeters and midrange drivers both connected in series to their respective filter networks. Comprehensive overload protection is provide by the three Polyswitch PTC thermistors.

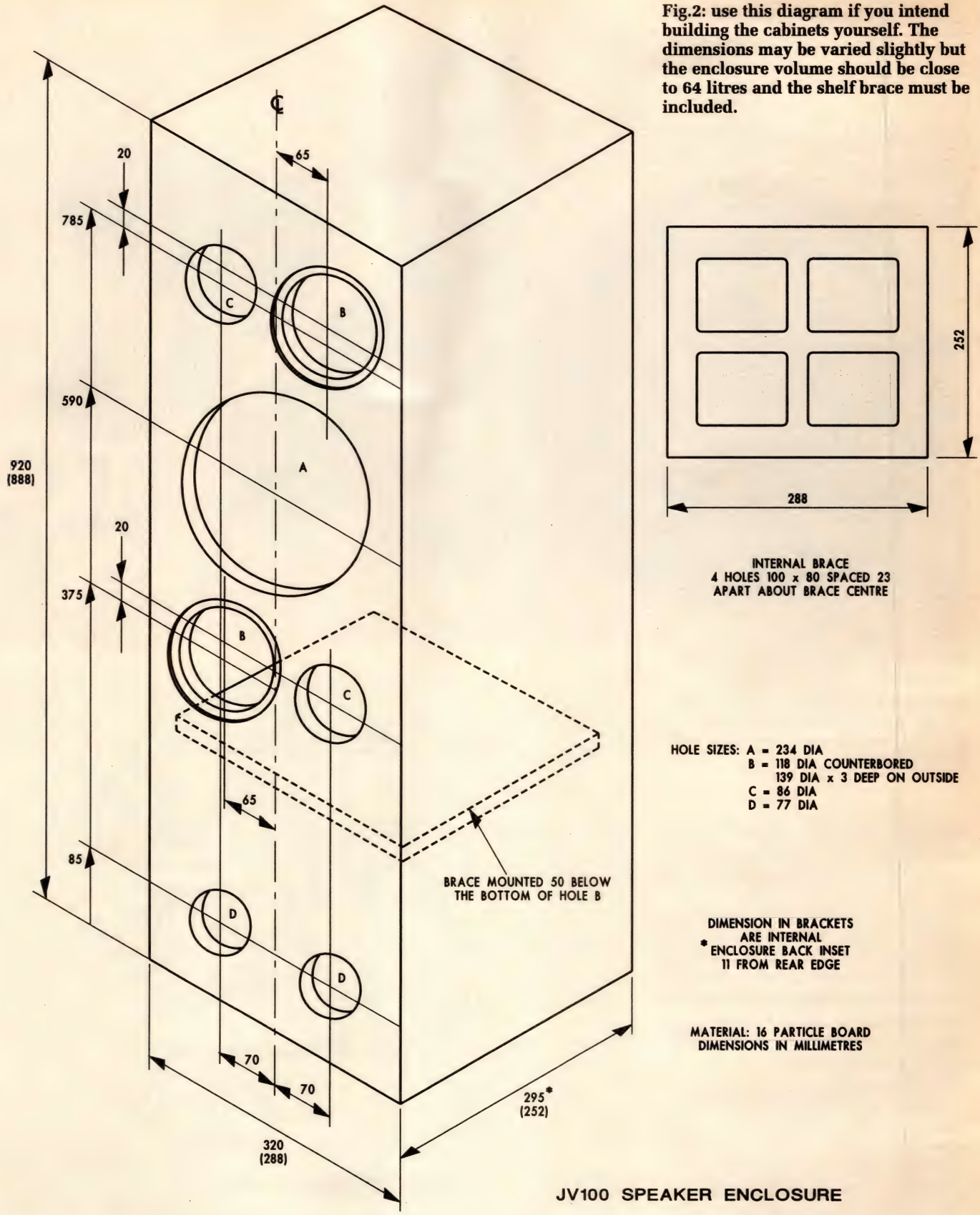


Fig.2: use this diagram if you intend building the cabinets yourself. The dimensions may be varied slightly but the enclosure volume should be close to 64 litres and the shelf brace must be included.

panel connector which can then be screwed into place. This panel should be mounted with the terminals facing down. This makes it easier to secure the speaker wires from the amplifier. The terminals are quite large so you will have no trouble even if you are using very thick speaker cables.

Connect and solder the two wires to the tweeters. Note that an intermediate wire runs between the positive terminal on one tweeter and the nega-

Kit Availability

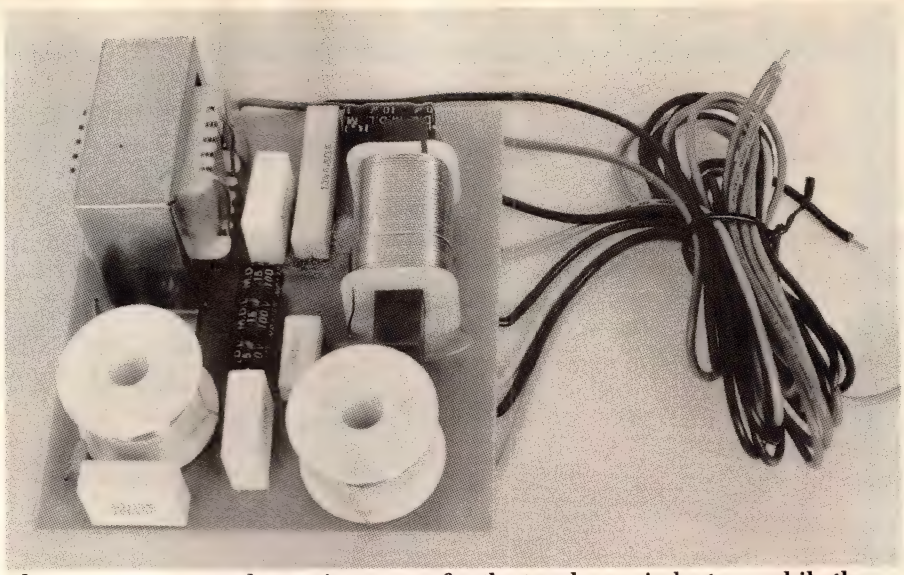
Kits for the JV100 loudspeakers are available from all Jaycar Electronics stores and their dealers. Prices are as follows:

(1) Speaker kit – includes two woofers, four midrange drivers, four tweeters, two crossover networks, two rear terminal panels, Innerbond and mounting screws: $1179.00.

(2) Cabinet kit – includes a pair of cabinets finished in blackwood veneer, complete except for the pre-cut baffles which must be mounted in place: $298.00.

(3) A pair of assembled and finished grille cloth frames: $80.00.

Alternatively, you can purchase the complete kit for a pair of speakers for $1499.00.



The crossover network uses iron cores for the two larger inductors, while the other two are air-cored.

tive terminal on the other. This is most important for phasing.

Next to be fitted are the midrange drivers. Note that while the midrange drivers may appear to be incorrectly phased in Fig.1, the diagram is correct. It is conventional for the phase of the midrange drivers to be reversed to that of the tweeter and woofer. This normally gives the best sound quality.

Again, there is an intermediate wire between the positive terminal of one midrange and the negative terminal of the other. The wires for each midrange need to be passed through the small hole in the end of the plastic enclosure. After the wires are soldered to the drivers, the access hole in each plastic enclosure is plugged with the supplied sealant, to make it airtight.

Each midrange and its plastic enclosure is then dropped into position in the baffle and secured with four screws. Next, insert half the supplied Innerbond filling material into each enclosure. This can be loosely tacked into place.

Finally, solder the remaining two wires to the woofer and mount it on the baffle with four screws. Do not over-tighten any of the screws because it is fairly easy to strip the holes. If this happens, rotate the speaker, drill pilot holes in a different position and re-fasten all the screws. Be very carefull when you are wielding your screwdriver during this assembly procedure. If you are careless, you could slip and damage one of the driver's cones and that could mean an expensive repair.

When you have completed one loudspeaker system, hook it up to your amplifier and have a listen. If all is well, go ahead and assemble the other loudspeaker. If the sound is not quite right, check that you have connected all the speakers correctly. If the phasing is wrong, the sound can be quite strange and may even have a disembodied quality. That won't happen to you, provided you have been very careful. **SC**

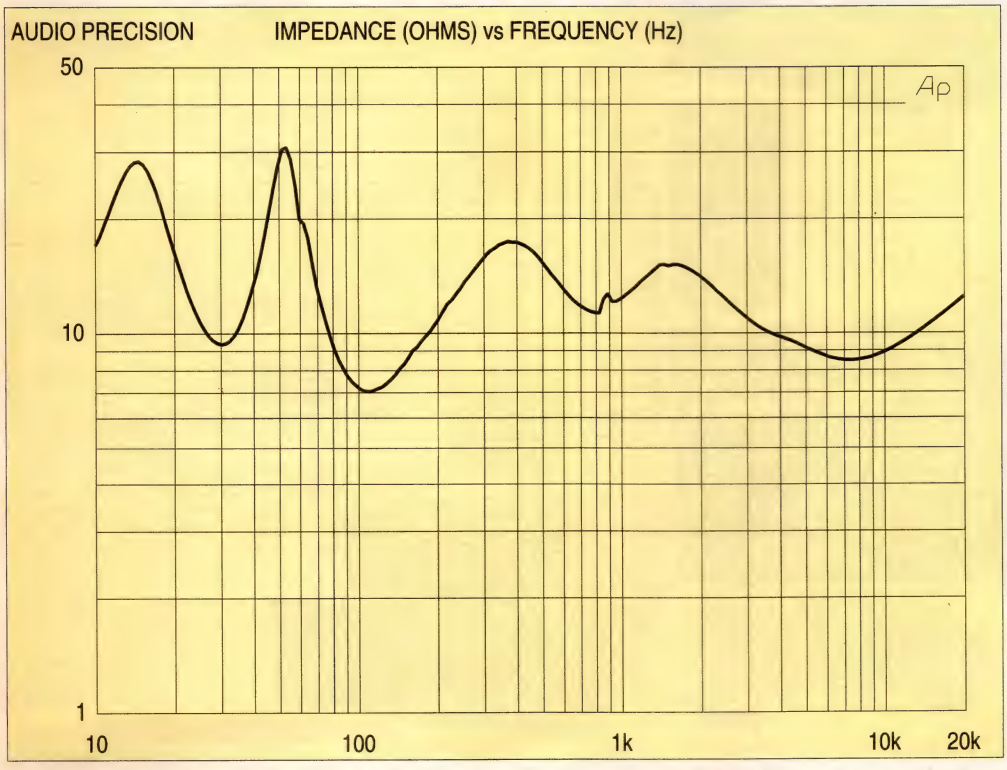


Fig.3: this is the impedance plot for the JV100 speakers. We plotted a curve for each of the prototypes and they were virtually identical.

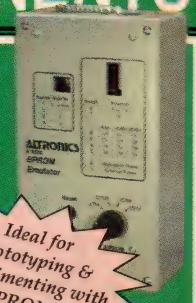
ALTRONICS COMPONENTS

ALTRONICS Fax Order Line: (09) 328 3487

ALTRONICS

For *Ultra Quick* delivery
Phone Order on 1-800 999 007.
Jetservice Delivery - next day all capital cities and suburbs, please add 24 - 48 hours for country clients.
Regards, **Jack O'Donnell**, Managing Director

EPROM Emulator Kit

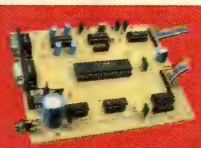


This EPROM emulator allows you to do away with EPROM's whilst in the prototyping stage of product development. The emulator is connected to a spare parallel port on your computer and also the 'target' board. The EPROM file (that is normally downloaded into the EPROM), is then transferred into the emulator by copying the file to the parallel port. This process saves repetitively "blowing" new EPROM's with each modification to the program. Emulates 2764, 27128, 27256 and 27512 EPROM's.

Ideal for Prototyping & Experimenting with EPROM's

K 9530 ***Just* $149**

I/O Adaptor Kit for PC's



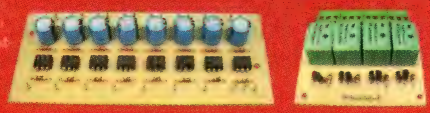
(See EA July '91)
Using this module you can computer control all kinds of things such as security systems, stage lighting, model railways, watering systems etc. The unit simply connects to a standard RS232C serial port on any PC. Features 8 digital inputs controlling 8 outputs. A simple addressing systems allows multiple units to be "daisy chained" from a single RS232C port, expanding the number of inputs and outputs up to 64.

K 2850 **$69.95**

Input Buffer & Relay Driver Kit

Combined, the K 2850 & the K 2852 Allow You to Switch On and Off Appliances with Your Computer!

(See EA Feb '89) This is a companion kit for our I/O Adaptor kit (K 2850). It has four relay outputs and eight opto-isolated inputs. This kit contains all parts necessary to construct both the input and output stages and even gives basic information on 240 volt triac controlling. As there is no professional software available for these items, a Qbasic program listing is supplied to help you complete your project.



K 2852
$34.95

Electronic Ignition System Kit

(See SC May '88) This "state of the art" electronic ignition system uses the same semi-conductors as found in modern motor car ignitions. Extends the life of plugs and points. Increases power and improves fuel economy. Compatible for 4, 6 and 8 cylinder engines. Install one into your car and start saving $$$ from the very first day. Comes with full explanation of your vehicle's ignition system.

K 4015 $58.50, **This Month $49**

Induction Loop Pickup Kit

(See EA Oct '95) Here is a novel way to listen to the television, CD etc with headphones but without long wires back to the set. Handy for listening to TV in bed, or for getting 'that little bit more volume' without irritating other members of your family. This works on the same principal of induction loops for hearing aids. Simply set up by laying cable around the ceiling or floor of the room. Full details supplied. Receiver can fit in pocket etc. Does not include earphones. **C 9005** Earphones to Suit **$19.95.**

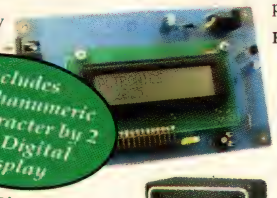
K 5200 **$24.95**

Gain Controlled Mic Preamp Kit

(See SC Aug '95)
Designed for use with PA systems this unit simply plugs in between your balanced microphone and amplifier. It will monitor the microphone input level, and adjust the volume to maintain a constant output level. This will ensure that the amplified sound level is always the same, regardless as to how loudly (or softly) a person speaks. Includes an XLR type socket for a balanced microphone input, and an unbalanced 6.35mm output socket. Requires 9V DC M 9105 power supply (not included).

K 5520 **$29.95**

Alphanumeric LCD Module Kit



(See SC May '93) Using an alphanumeric LCD display board is not as hard as you may have thought. This kit is certainly the easiest way of learning about these devices. Simply connects straight to your printer port of your PC. N.B. requires software.

Includes Aplphanumeric 16 Character by 2 Line Digital Display

K 2825 **$39.95**
K 2827 3.5" PC Software Disk **$14.00**

Fast Nicad Battery Kit

(See SC Jan '91) Operating from a 12V DC battery, this charger can charge 6V to 12V nicad battery packs at up to 6A, or you can custom wire the unit to charge battery packs up to 30V at a reduced current. In operation the circuit will recharge a typical nicad racing pack in about 20 minutes. **Features:** • Fast charge rate • Switch selectable voltage setting in 1.2V steps from 6-12V • Fully punched and screened front panel • State of the art digital circuitry

K 1660 Normally $129.00, **This Month Only $99**

16 Second Message Recorder Kit

(See SC July '93) This is an interesting kit that makes use of new technology to record audio signals. Whilst most recorders store the audio in digital form and thus require back up power, the IC in this kit stores the signal in analog form and can retain the information for up to 10 years. Can store one message of up to 16 seconds. Simple Record and Playback pushbutton operation. Kit includes speaker, professional screen printed front panel etc.

K 9560 $69.95, **This Month Only $49**

40 Volt 3 Amp Variable Power Supply Kit

Includes LCD Digital Display for Precise Measurement!

(See SC Jan/Feb '94) This 1.23 V to 40 V adjustable power supply is designed for heavy-duty work. It uses a high efficiency switching regulator circuit. Features preset voltage and current limiting, full overload protection (with indicators) and an LCD panel meter for precise voltage and current readouts.

K 3330 **$239.95**

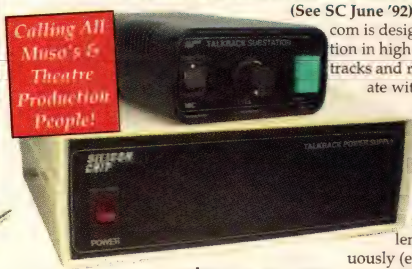
350W Amp Module Kit

This fantastic amplifier will deliver a massive 350 watts RMS into 4 ohms. Using the latest mosfet technology and circuit design techniques this kit is supplied as a basic module, which makes it ideal to be built into subwoofer enclosures, juke boxes and mixers etc. Housed in a suitable enclosure this kit will make a simple superb mono or stereo (using 2 modules) high power amplifier for discos, public address or even in the home if you are game enough to really rattle the floor boards!

K 5180 **$189** *Call Us for a Free Power Supply Spec Sheet!!*

Multi-Station Headset Intercom Kit

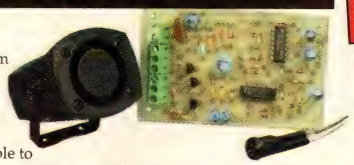
Calling All Musos's & Theatre Production People!



(See SC June '92) This multi-station headset intercom is designed to provide clear communication in high noise environments such as at race tracks and rock concerts. It is designed to operate with a headphone and mic combination. Each headset requires a station module. Stations are simply connected in a daisy-chain fashion. Up to 12 units (stations) can operate from one power supply. Features low noise circuity and compares favourably to commercial equivalents. Mics can be switched on continuously (even at the one time) for hands free operation of all stations. Also includes visual and audio call function. Ideally suited to our C 9055 headset mic and the C 9070 noise attenuating Aviation Headset.

K 5250 Station Module **$74.95**
K 5255 Power Supply **$64.95**

Screecher Car Alarm Kit



(See EA Aug '86) Here is a low cost car alarm designed with a new deterrent strategy. Instead of using the alarm to try and draw attention of passers-by to the felony in progress, this alarm sounds inside the car to deafen the thief and make it too uncomfortable to proceed. Makes an ideal second/back-up alarm. Deafening 110dB Modulated Tone. Two sensor inputs - Normally open and normally closed enable simple connection to door, bonnet, boot light, switches etc.

K 4360 Normally $49.50, **This Month Only $39**

Cheap Peace of Mind for Your Car

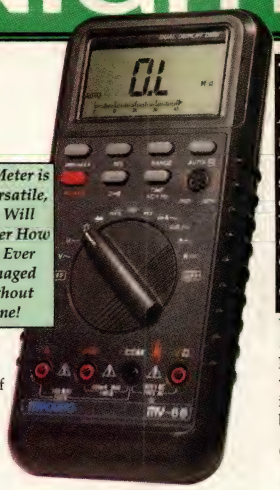
1-800 999 007 PERTH (09) 328 1599

Doc.JH000

OVERNIGHT DELIVERY

ALTRONICS Fax Order Line: (09) 328 3487

3.75 Digit Dual Display Auto Ranging Digital Multimeter



One of the Best and Most Popular Meters We've Ever Stocked!

This Meter is So Versatile, You Will Wonder How You Ever Managed Without One!

This fantastic auto-ranging meter features minimum and maximum functions. Memorise an input for later reference. Continuity and diode check. Can measure AC voltage and frequency simultaneously. Capacitance test 4nF to 40μF. Frequency check 10Hz to 120kHz. Transistor gain check for both NPN and PNP transistors. 41 segment analogue bargraph, stopwatch function, 10 amp fuse protection and full 2 year warranty. Relative sampling displays either % or actual value difference of the current input compared to a memorised input. Auto power off. Large 16mm 3.75 digit display with bargraph.

Please call us or a full specification sheet.

Q 1045 **$179**

19 Range Digital Multimeter

Amazing Meter for Under $30!

After evaluating 30 or more meters of this calibre we found the Q 1053 to be the best value for money by far!

This 3.5 digit multimeter features a 19 position, easy to use rotary switch for function and range position. Includes AC/DC voltage check, 10A DC current, resistance, diode and a transistor test function. This meter offers many of the features of much more expensive models but at the fraction of the cost. Ideal for the cash strapped student, or budding enthusiast!

Q 1053 Normally $39.95, This Month Only **$29.95**

Logic Probes

Features audio and visual 'hi' and 'low' indication. Detects pulsing signals down to 30ns pulse duration. TTL and CMOS compatibility at the flick of a switch. Makes observation and fault finding of any digital circuit easy!

Q 1272 20MHz Logic Probe **$39.95**

AC/DC Low Voltage Test Probe

Ideally suited for tracing or locating voltages up to 24V AC or DC. Excellent for working on cars, boats or trucks electrical systems. Simply place one probe to earth and place the other probe onto the wire to be checked. If voltage is available the corresponding (6, 12 or 24V) LED will light. Very simple to use.

Q 1230 **$7.25**

High Power 6 Tone Sirens

Scoop Purchase! Normally $39.95 Save Over 50%

Massive 120dB Output!

Continuously cycles through 6 different alarm sounds, each of 6 seconds duration. Each tone can be enabled/disabled via internal DIP switches. Certainly attracts some attention! Requires 12V DC at 1.2A. Dimensions ≈80mm Ø by ≈80mm Long (excluding the bracket).

Hurry, Stocks are Strictly Limited at This Price

S 6134 **$19.95**

High-Tech Remote Car Alarm

This amazing model features just about everything you could imagine! Multi-function keyring remote control will arm and disarm alarm (and activate central locking if fitted), chirp the horn, turn on the car headlights, panic and even open the boot (if actuator fitted). One remote can control two alarms (in two cars). Other features include starter inhibit, valet mode, central locking interface, flashes car indicators when tripped, auto reset, user programmable options plus much more.

Save a MASSIVE $100

S 5230 Normally $249.00

This Month Only **$149.95**

Hurry - Only 14 Left!

Solar & Battery Powered AM/FM Radio

Fantastic for sports fans and lovers of the great outdoors! No need to worry about batteries next time you go to the cricket or out gardening etc. Inbuilt solar cells will charge the internal nicad battery. Will automatically use a standard (non-rechargeable) AA battery should the nicad run out (ie. night time use). Supplied complete with earphones!

A 2250 Normally $39.95, This Month Only **$29**

Solar, Dynamo & Battery Powered AM/FM Radio

Features: Built in solar panel and dynamo generator, can be fitted with 2 "AA" batteries (for backup at night) and provision for DC external plugpack. Built in nicad backup battery is charged by the radio's own solar panel.

A 2255 Normally $49.95, This Month Only **$39**

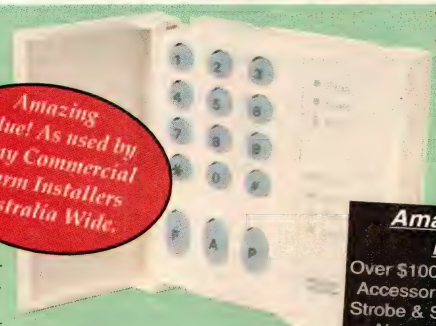
Altronics Retail Store Perth

Now Open Extended Hours

Saturday - 8:30am to 5:00pm

Sunday - 12:00pm to 5:00pm

Professional 4 Sector Digital Alarm System with Auto Dialler



Amazing Value! As used by Many Commercial Alarm Installers Australia Wide.

This alarm panel is the same type as used by many commercial alarm companies to protect both residential and commercial properties.

Incorporating an inbuilt Austel approved auto-dialler, this great alarm can be configured to automatically dial two preset numbers in the event of an alarm, i.e. could be configured to automatically ring a neighbour or an alarm monitoring company. The main controller circuitry is housed in a sturdy steel cabinet. Provision is made to house an optional back up battery if required. The keypad control unit is generally located at the front door for easy access to arming and disarming of the system. The entire system is controlled and programmed via this keypad. Virtually any type of sensor can be used with this system. A combination of normally open and normally closed sensors can be used on any zone. Each zone is monitored by end of line resistors to maintain system integrity, i.e. if someone interferes with the system wiring the alarm will sound immediately.

Features: • master code and three adjustable user codes • monitor function which tests features like battery backup and mains failure • four individually programmable sectors with a large array of functions available • all four sectors utilise extensive noise protection circuitry and end of line resistors for added security • once triggered the alarm has the option of a silent alarm, and dialling a friend or monitoring company • quick arming option • zone bypassing for sectors which are false triggering • bell test - to test the external sirens without dialling out • door chime mode for entry/exit paths • battery backup • home or away operation • accessible alarm memory for confirming which sectors were triggered • separate instruction and installation manuals • 12 months warranty

S 5490 **$299**

M 9140 16V AC Plug Pack with Earth to Suit $32
S 5492 Extra Keypads to Suit $135 ea
S 5065 12V 1.2AH Backup Battery to Suit $32.50

PIR Movement Detector

5 Year Warranty

Small and sleek this detector is ideal for the home or the office. Range up to 13 x 13m. **Features:** • LED On/Off Jumper • Vertical Adjustment • Wall/Corner Mounting • Small Size - 62w x 88h x 48d mm • 5 Year Warranty

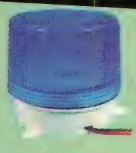
S 5307 **$49**

Ideal for the S 5490 Alarm Opposite

Amazing Bonus Package

Over $100 Value of Installation Accessories Including Cable, Strobe & Siren Free with Each Alarm System Purchase!

50 Metres of High Quality 4Core Security Cable (Sufficient for average 4 bedroom house). W 0356



High Intensity Strobe S 5455

Siren Horn S 6130

2 Large Alarm Stickers - S 5400
Plus 4 Window Stickers - S 5410

1-800 999 007 PERTH (09) 328 1599

Doc.JH000

ALTRONICS COMPONENTS

ALTRONICS Fax Order Line: (09) 328 3487

Micron Sure Shot Desoldering Tool

Exclusive to Altronics in Australia. This stand alone, fully self-contained desoldering tool makes it a breeze to remove components from any PCB. Even double sided, through hole plated boards. All it needs is a squeeze or two on the trigger and the component virtually falls out. Features: • Totally self contained • Light and compact • Anti static tip • Easy to use • Simple to clean and maintain • Variable tip temperature. The ***Sure Shot*** generates a high speed vacuum every time the trigger is squeezed. This vacuum causes the molten solder to flow into the collection reservoir contained within the unit. Here the molten solder solidifies into small particles. With its inbuilt variable temperature control the ***Sure Shot*** is ideal for single sided, double sided and through hole plated P.C.B.'s. With just a couple of squeezes of the trigger all holes are left solder-free for easy removal of the component.

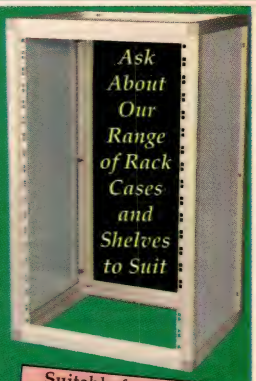
De-Solders a 14 Pin IC Socket in Around 30 Seconds!

T 1280 $349

T 1282 1.0mm Replacement Tip to Suit **$34.95**
T 1283 1.6mm Replacement Tip to Suit **$34.95**

Bonus This Month - Receive a Free Bench Stand Valued at $24.95

Professional Rack Frame and Panel Set Sell Out



These quality frames are manufactured from a heavy duty and professional looking natural anodised aluminium. The side and top panels are available separately with industrial grade Horizon Blue powder coat. Ideal for use in home Hi-Fi systems, professional audio installations, Band Gigs, Computer patch panels etc. Supplied in flat pack form. Easily assembled in minutes with minimal tools and effort.

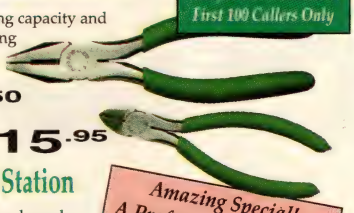
		Were	This Month
H 5204	Rack frame 4U	$139.00	$97
H 5205	Panel set for H 5204	$59.00	$41
H 5212	Rack frame 12U	$169.00	$118
H 5213	Panel set for H 5212	$99.00	$69
H 5218	Rack frame 18U	$189.00	$132
H 5219	Panel set for H 5218	$119.00	$83
H 5230	Rack frame 30U	$229.00	$160
H 5231	Panel set for H 5230	$169.00	$118
H 5238	Rack frame 38U	$269.00	$188
H 5239	Panel set for H 5238	$199.00	$139

Suitable for home or commercial use, these fantastic rack frames are durable, strong, good looking, light weight and easy to assemble.

Save 30% Hurry - Stocks Strictly Limited!

Super Heavy Duty Pliers & Cutters

This Month Only Buy Both for $20 - Limited to First 100 Callers Only



Special high quality steel for excellent cutting capacity and durability. Handles are coated in long lasting and comfortable grips. Ideal for cutting heavier gauge electrical wire.

T 2800 Pliers Length ≈210mm. **$9.50**

T 2830 Side Cutters Length ≈160mm. **$15.95**

Micron Series II Soldering Station

Amazing Special! A Professional Soldering Station for Under $100. Why Pay $160 or More?

The *MICRON* Series 2 soldering station employs electronic switch mode circuitry in lieu of a mains transformer. Excellent for all general purpose and production soldering.

Features: • High insulation ceramic heating element • Rapid heat-up and instant recovery • Heater insulation of over 100MΩ • A zero voltage circuit ensures no high voltage spikes or magnetic field are present at the tip to damage sensitive components • Continuous temperature adjustable from 250° to 430°C (480° to 800°F) • Grounded power cord • Selecting the desired operating temperature is as simple as turning a knob. *Now Supplied with Long-Lasting Iron Clad Tip!*

This Month Only $99

T 2443 Normally $129.95

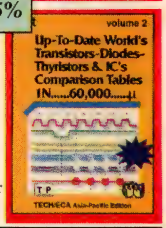
Up-to-date Worlds Transistors Diodes Thyristor IC's Comparison Tables I

Volume one lists comparison tables of nearly 28,000 types of components. It lists over 80,000 comparisons and equivalents. Lists semiconductors with prefixes A - Z. 1095 pages.

B 1265 $19.95

Buy Both Volumes for **$29** *and Save 25%*

Up-to-date Worlds Transistors Diodes Thyristor IC's Comparison Tables II



B 1270 $19.95

This extremely compact book of equivalents gives brief description and specification as well as full pin assignments of 28,000 types of transistors, diodes, thyristor and IC's. An excellent reference book for professionals and hobbyists alike. 954 pages.

Altronic Dealers Wanted

If you have a dynamic electronics business and would like to sell Altronic Products and Components - We would like to hear from you! Contact Greg Liddelow at Altronic Distributors Wholesale on (09) 328 2199.

ALTRONICS

174 Roe St. Perth W.A. 6000
Phone (09) 328 1599, **Fax** (09) 328 3487
MAIL ORDERS C/- P.O. Box 8350
Perth Business Centre, W.A. 6849

We welcome ... bankcard MasterCard VISA

Standard Delivery & Packing Charge: $4.00 to 500gms, $5.50 500gms-1 kg, $8.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

Overnight Jetservice: Up to 3kg is $10.00, 3kg to 5kg is $18.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

Heavy Service: All orders of 10kgs or more must travel Express Road—Please allow up to 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs. **Insurance:** As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance". **Altronics Resellers:** Chances are there is an Altronics Reseller right near you—check this list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ●. These dealers generally carry a comprehensive range of Altronic products and kits or will order any required item for you.

WA - COUNTRY			**COUNTRY**			**NT**		
ALBANY	BP Electronics ●	(098) 412681	BALLARAT	Ballarat Electronics	(053) 311947	ALICE SPRINGS	Farmer Electronics	(089) 522388
	Micro Electronics	(098) 412077	BENDIGO	Sumner Electronics	(054) 431977	KATHERINE	Logicware	(089) 723030
BUNBURY	Micro Electronics	(097) 216222	MILDURA	Truscott Electronics ●	(050) 238138	**SA - CITY**		
ESPERANCE	Esperance Comm.	(090) 713344	SHEPPARTON	Andrew Guyatt Elect.	(058) 219497		Force Electronics ●	(08) 2125505
KALGOORLIE	Golden Mile Electronics	(090) 215212	**QLD - CITY**			BRIGHTON	Force Electronics ●	(08) 3770512
PORT HEDLAND	Ivan Tomek Electronics	(091) 732531		Delsound PL●	(07) 38396155	ENFIELD	Aztronics ●	(08) 3496340
ROCKINGHAM	TV Joe's	(09) 5271806	NEWSTEAD	E.C.Q.	(07) 32541153	FINDON	Force Electronics ●	(08) 3471188
VIC - CITY			WEST END	B.A.S. Audiotronics	(07) 38447566	HOLDEN HILL	Force Electronics ●	(08) 2617088
	All Electronic Comp.	(03) 96623506	WOODRIDGE	David Hall Elect.●	(07) 38082777	LONSDALE	Force Electronics ●	(08) 3260901
	TECS ●	(03) 96706474	**COUNTRY**			SALISBURY	Force Electronics ●	(08) 2830755
CHELTENHAM	Talking Electronics	(03) 95842386	GLADSTONE	Gladstone Elect. Services	(079) 724459	**NSW - CITY**		
CLAYTON	TECS ●	(03) 95629501	MAROOCHYDORE	Mals Electronics ●	(074) 436119		David Reid Elect. ●	(02) 2671385
CROYDON	Truscott Electronics ●	(03) 97233860	TOWNSVILLE	Super Solex ●	(077) 724466	SMITHFIELD	Chantronics	(02) 6097218
FOOTSCRAY	G.B. Telespares	(03) 93266035	**TAS**			**COUNTRY**		
PRESTON	Preston Electronics ●	(03) 94840191	HOBART	G.H.E. Electronics ●	(002) 342233	COFFS HARBOUR	Coffs Habour Elect.	(066) 525684
			LAUNCESTON	G.H.E. Electronics ●	(003) 316533	NEWCASTLE	Novocastrian Elect.Supplies	(049) 621358
						WARNERS BAY	Vilec Distributors	(049) 566792
						WOLLONGONG	Newtek Electronics ●	(042) 271620
							Vimcom Electronics	(042) 284400

1-800 999 007 **PERTH (09) 328 1599**

Doc.JH000

SILICON CHIP

ORDER FORM

BACK ISSUES

MONTH	YEAR	MONTH	YEAR	PRICE EACH (includes p&p)	TOTAL
				Australia (by return mail) $A7; NZ & PNG (airmail) $A7; Overseas (airmail) $A10. Note: Nov 87-Aug 88; Oct 88-Mar 89; Jun 89; Aug 89; May 90; & Nov-Dec 92 are sold out. All other issues are currently in stock.	$A

BINDERS

Please send me _____ SILICON CHIP binder(s) at $A14.95 each (incl. postage within Australia). NZ & PNG orders please add $A5.00 each for postage. Not available elsewhere. **$A**

SUBSCRIPTIONS

❑ New subscription – month to start_____

❑ Renewal – Sub. No._____ ❑ Gift subscription ☞

RATES (please tick one)	2 years (24 issues)	1 year (12 issues)
Australia	❑ $A90	❑ $A49
Australia with binder(s)*	❑ $A114	❑ $A61
NZ & PNG (airmail)	❑ $A135	❑ $A72
Overseas surface mail	❑ $A135	❑ $A72
Overseas airmail	❑ $A240	❑ $A120

*1 binder with 1-year subscription; 2 binders with 2-year subscription

GIFT SUBSCRIPTION DETAILS

Month to start_____

Message_____

_____

_____

Gift for:
Name_____
(PLEASE PRINT)

Address_____

_____

State_____Postcode_____

YOUR DETAILS

Your Name_____
(PLEASE PRINT)

Address_____

_____Postcode_____

Daytime Phone No._____ **Total Price $A** _____

❑ Cheque/Money Order ❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | | |

Signature

_____

Card expiry date_____/_____

Phone (02) 9979 5644
9am-5pm Mon-Fri.
Please have your credit card details ready

OR

Fax (02) 9979 6503
Fax the coupon with your credit card details
24 hours 7 days a week

OR

Mail coupon to:
Reply Paid 25
Silicon Chip Publications
PO Box 139, Collaroy 2097
No postage stamp required in Australia

Rail

A Walk

PART 2: Last month, we presented the circuit details of our new Railpower Mk.II controller. We follow up this month with the construction details and a testing procedure for the completed unit. It can be run from a standard 12V battery charger or a model railway power supply.

By RICK WALTERS

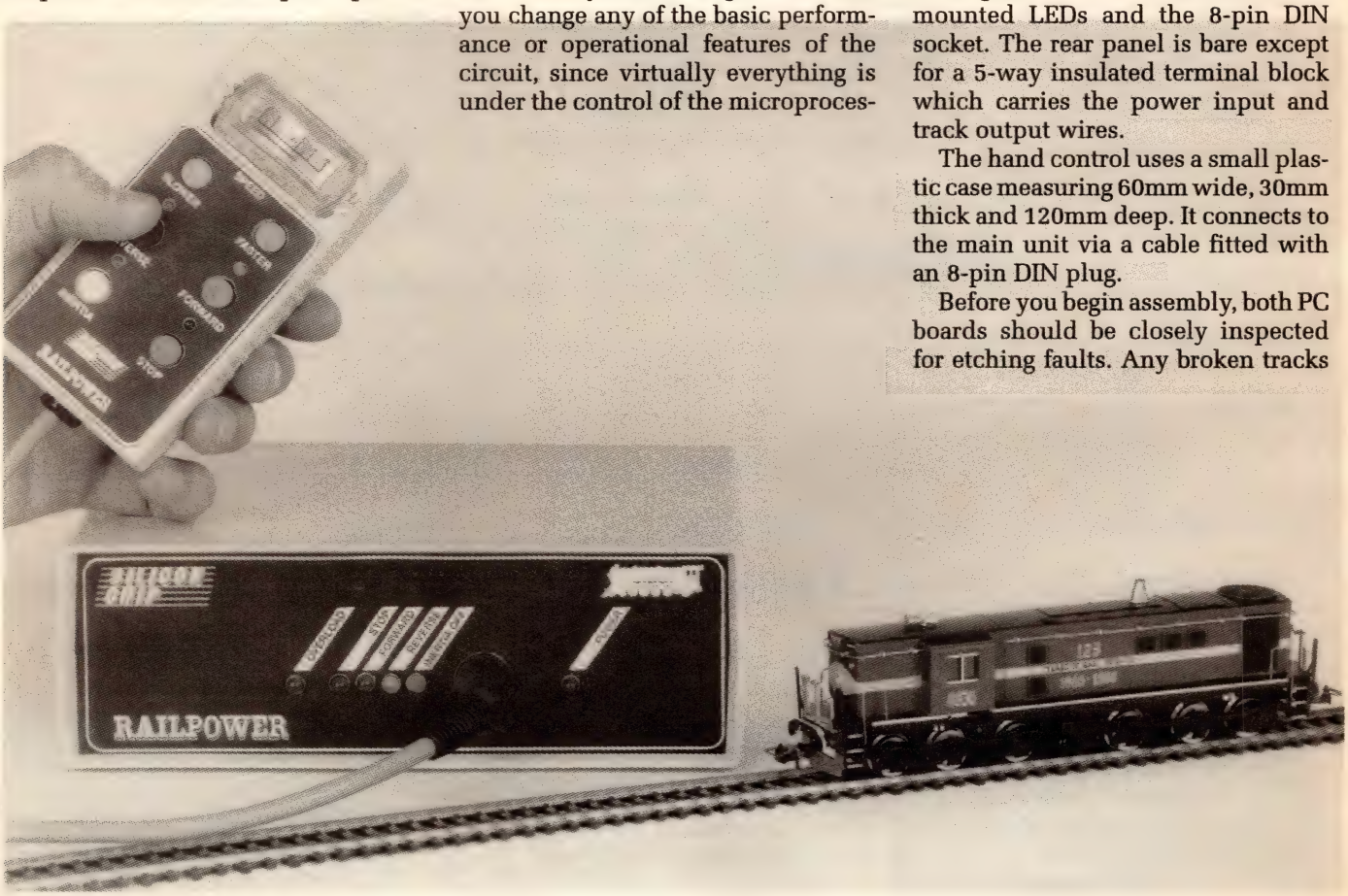
LET'S STATE AT THE OUTSET that the Railpower Mk.II is a highly flexible design and there is no reason why it has to be built up in the way we are presenting it in this article. We are featuring it in two plastic cases, one for the pushbutton control unit and a large case for the microprocessor-controlled pulse power board. Many people will probably want to build the main board into a large console while others will want to conceal it underneath their layout. So be it. You can do it in several ways.

Just remember that the basic circuit, as featured on the two PC boards, cannot be varied unless you really know what you are doing. Neither can you change any of the basic performance or operational features of the circuit, since virtually everything is under the control of the microprocessor; its internal programming is fixed and immutable. With that proviso, let us now describe the construction of our prototype.

The main pulse power board is housed in a standard plastic instrument case measuring 204mm wide, 67mm high and 156mm deep. The front panel features the six board-mounted LEDs and the 8-pin DIN socket. The rear panel is bare except for a 5-way insulated terminal block which carries the power input and track output wires.

The hand control uses a small plastic case measuring 60mm wide, 30mm thick and 120mm deep. It connects to the main unit via a cable fitted with an 8-pin DIN plug.

Before you begin assembly, both PC boards should be closely inspected for etching faults. Any broken tracks



power MkII:

Around Throttle For Model Railways

should be repaired and any shorts cleared with a sharp knife. In particular, look closely at the two thin tracks between the pads of IC1 on the main PC board.

Main board assembly

It is probably better to assemble the main board first. Its component overlay is shown in Fig.1. Fit and solder the five links, then the resistors and diodes. Next, fit the low profile capacitors and preset potentiometers. The four ICs are all oriented in the same direction, with the notched end facing the DIN socket end of the board. It is a good idea to solder the supply pins of each IC first, and then all the other pins. For IC1, the supply pins are 5 & 14, for IC2 & IC4, the supply connections are pins 16 & 8 while for IC3 they are pins 14 & 7.

Next, install the small signal transistors which are all BC338s except for Q12 which is a BC328. Then fit the larger components, ensuring that the electrolytic capacitors and the buzzer, are inserted with the correct polarity, as shown on the wiring diagram of Fig.1.

The four power transistors are mounted in back-to-back pairs, Q2 with Q6 and Q4 with Q8. This physi-

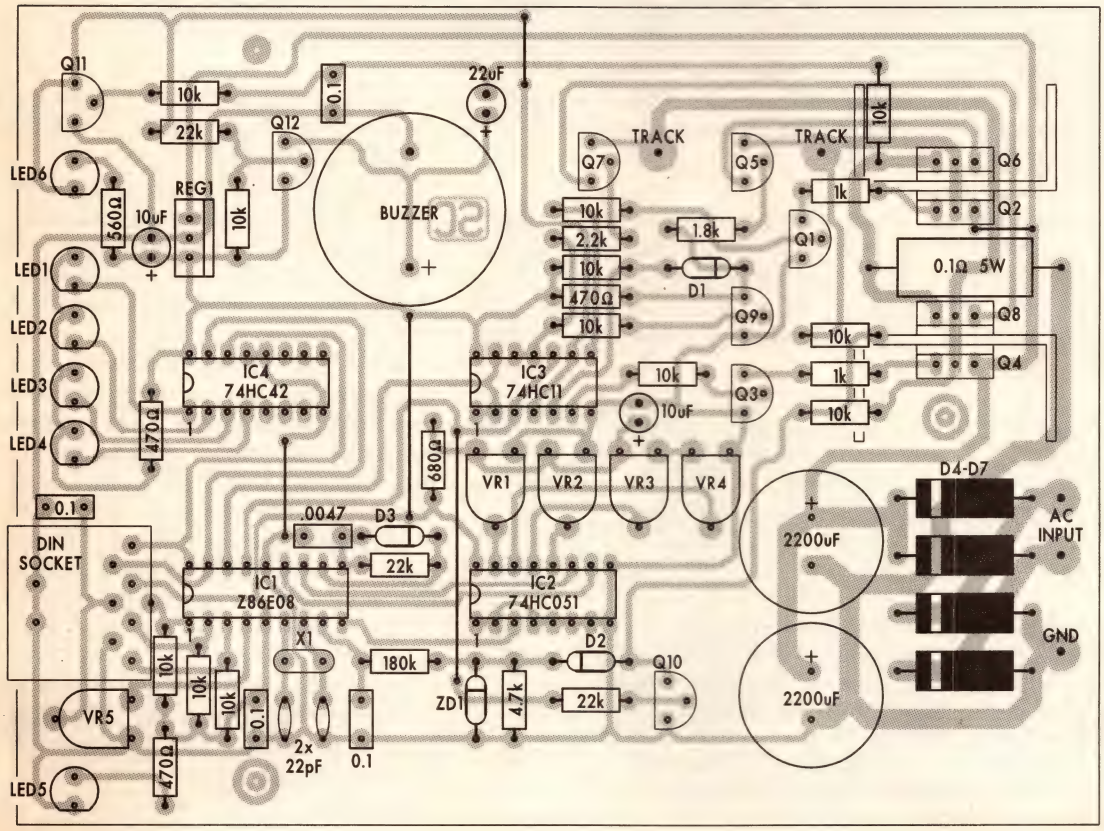
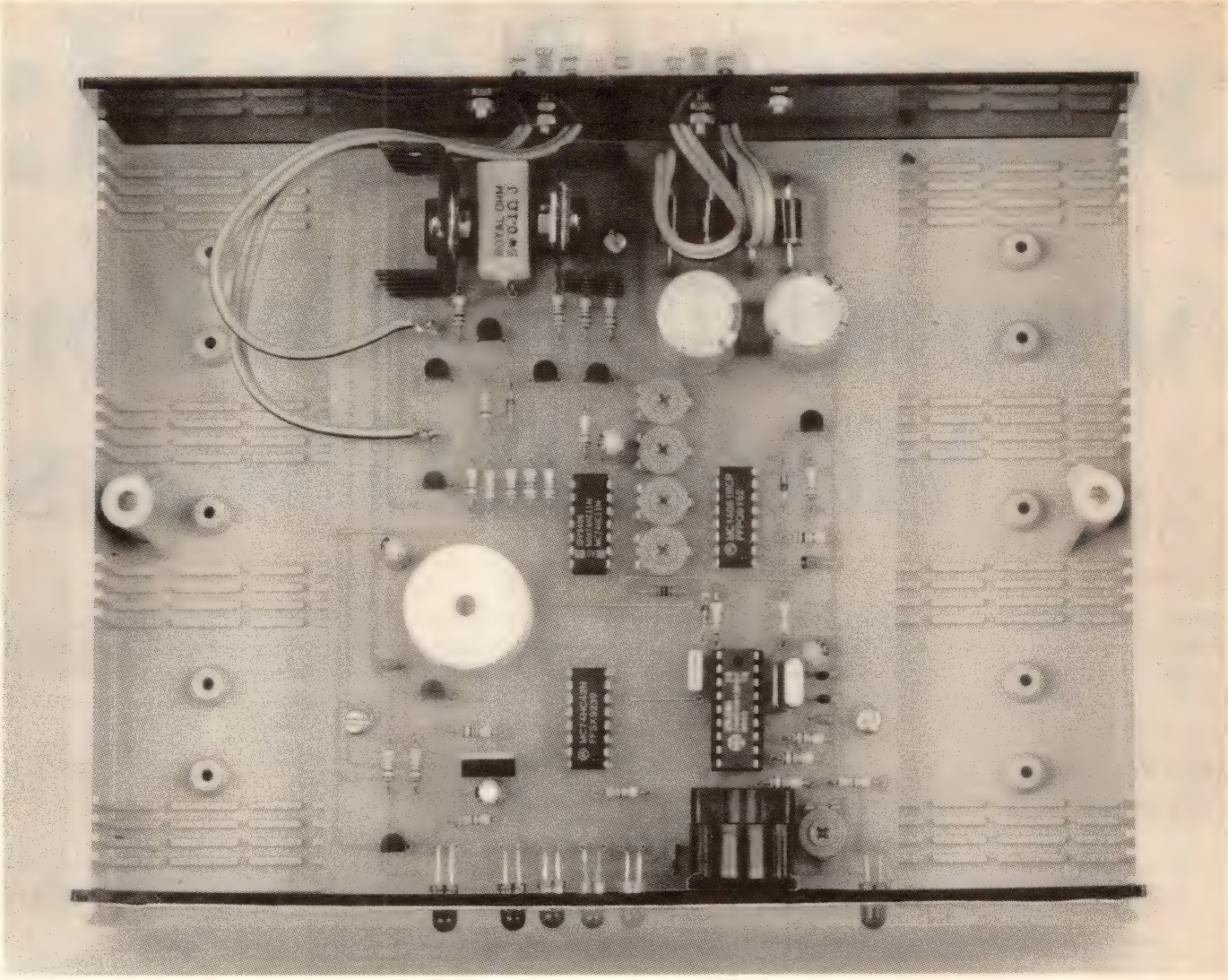


Fig.1: the component overlay for the main PC board. Note the heatsink assemblies for Q2 & Q6 and for Q4 & Q8. These have been drawn so as not to obscure the surrounding resistors although, in practice, they are mounted above these components.



A bird's eye view of the main PC board in the case. Note how the heatsink assemblies for the power transistors face outwards from each other. Don't get the transistors mixed up when you're mounting them otherwise they'll emit smoke when you turn on the power.

cally connects their collector tabs together with the heatsinks sandwiched between the metal tabs of the transistors. There is no need to use mica washers for the heatsinks but the metal collector tabs should have a light smear of heatsink compound before they are assembled and bolted together. In practice, we suggest you bolt the transistor pairs together with their heatsinks and then insert and solder the transistor pairs to the PC board – see Fig.2.

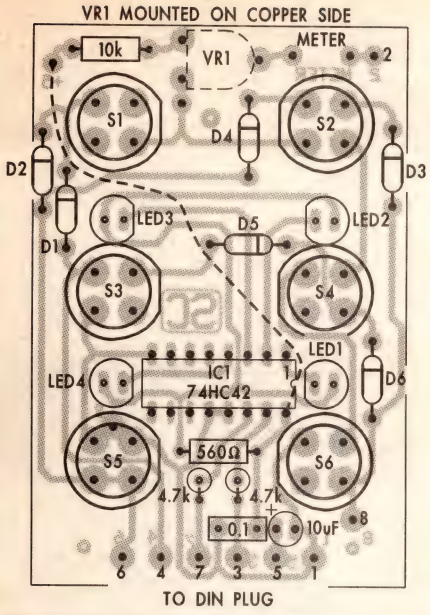
Fig.2: this diagram shows how the four power transistors are mounted in back-to-back pairs, Q2 with Q6 and Q4 with Q8. This physically connects their collector tabs together with the heatsinks sandwiched between the metal tabs of the transistors. There is no need to use mica washers for the heatsinks but the metal collector tabs should have a light smear of heatsink compound before they are assembled and bolted together.

Take particular care to make sure that you pair up the right transistor types and don't swap their connections around when mounting them on the PC board otherwise they will blow as soon as you apply power.

The LEDs should be tested before the leads are bent, as it appears that there are non-standard ones around. Normally, the longer lead is the anode, which should go to the more positive side of the circuit.

To test the LEDs use a 6V or 9V battery and the 560Ω resistor used in the hand control. Connect the resistor to the battery positive and the longer lead of the LED to the free end of the resistor. The other LED lead goes to the battery negative. If the LED lights it is a standard type; if it doesn't, reverse the LED leads.

If it now lights, cut a couple of



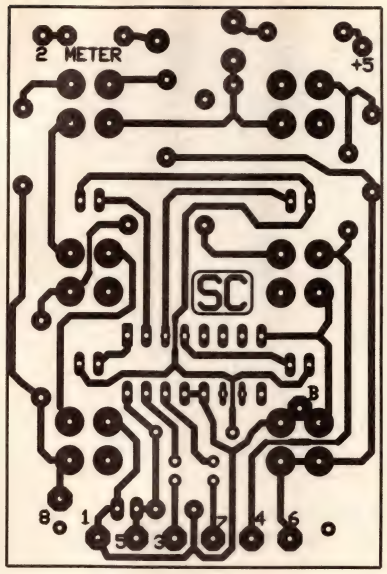


Fig.3 (left): this is the component overlay for the hand control board. Trimpot VR1 is mounted on the copper side of the board, as indicated by its dotted outline. Note the orientation of each pushbutton switch. Seven of the DIN cable connections are shown at the bottom of the diagram while the eighth, marked "2" is at the top righthand corner. Fig.4 at right shows the full-size PC etching pattern.

millimetres off the end of the longer lead, making it the shorter one. This way, all the LEDs will be similar when you come to bend them. If a LED still doesn't light, it is faulty and should be discarded.

While you have this test setup you should check the LEDs to be used in the hand control, but don't bend their leads, as they stay straight.

Looking at the LED leads with the longer one on the right, bend them both down, 8mm out from the LED body. The six LEDs on the main PC board should all have their leads bent this way.

Front panel

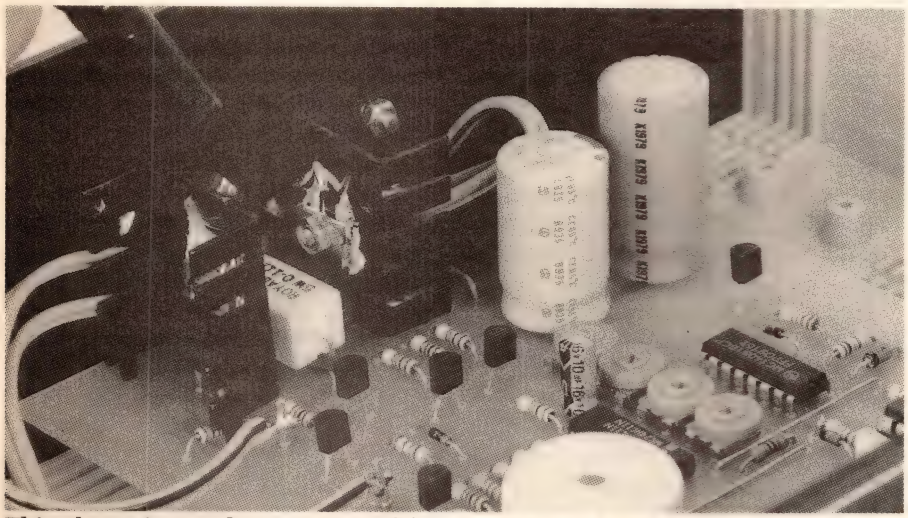
Before you solder the LEDs into the board, you need to check their alignment. Carefully affix the Dynamark label to the front plastic panel and drill out the six 5mm LED holes and the DIN connector hole.

Insert LED6 (red) and LED5 (green) into the PC board and solder one leg of each, leaving about 8mm of lead above the top of the board. Insert the LEDs through the front panel and slide the assembly into the guides at each end of the case.

Screw the PC board into the bottom of the case using 6mm spacers to lift the board off the plastic pillars. Check the alignment of the LEDs through the front panel holes. If all is OK, unscrew the PC board, fit the other LEDs with similar spacing and solder all the leads.

If you are not happy with the LED alignment make any necessary adjustments.

This completes the assembly of the main board. It cannot be tested without the hand control, so let's build that next. The component overlay diagram for its PC board is shown in Fig.3.



This photo gives a close-up view of the output transistor pairs. The collector tabs should have a light smear of heatsink compound before they are bolted to the heatsinks.

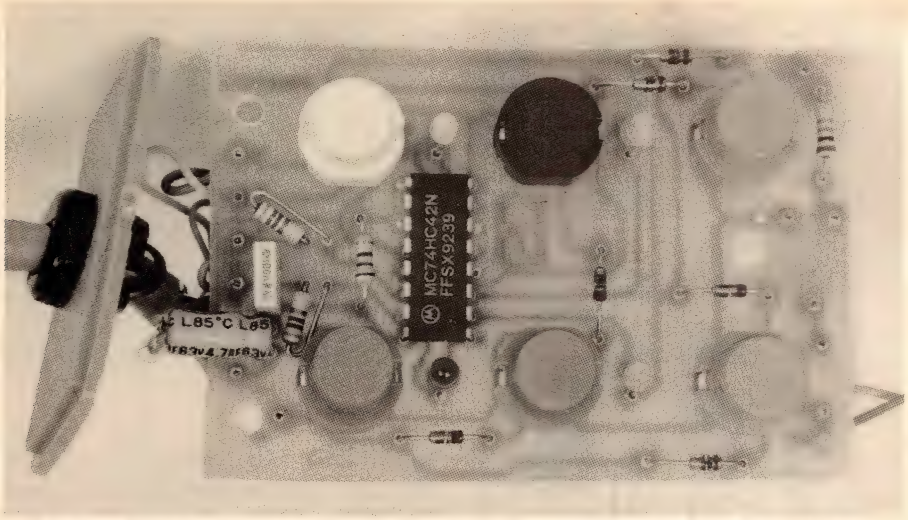
Fig.5: this diagram shows the pin numbers of the DIN plug, looking at the solder side. Solder pin 8 first.

Hand control board

After building the main board you will find this one much quicker and easier. Look carefully at the overlay and place the components as shown. Fit and solder the IC, resistors and diodes, making sure the resistors are bent over parallel to the board, or else they will be damaged when you mount the board in the case (see photo). Next fit the capacitors and push buttons making sure the flat side of each button faces the centre of the PC board.

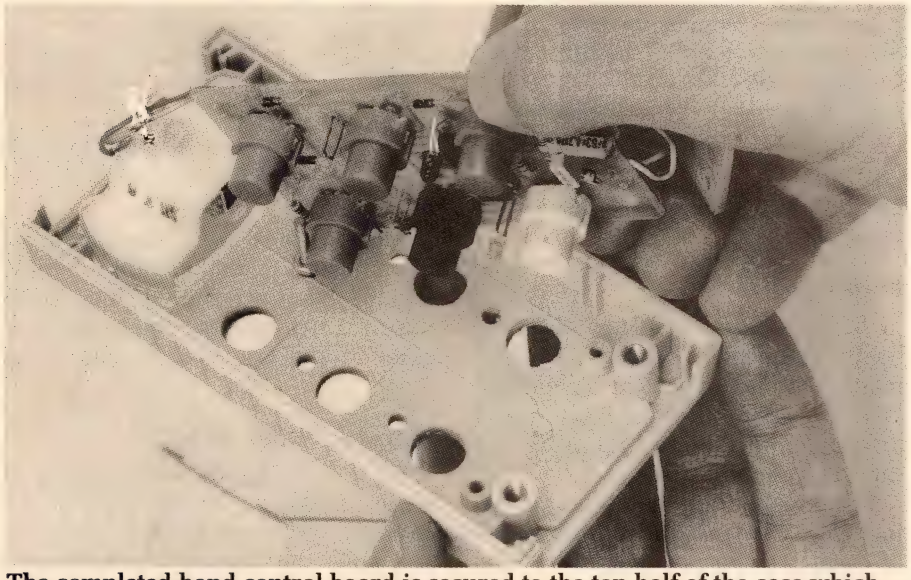
Run an insulated wire on the copper side of the board, from the pad adjacent to the 10kΩ resistor, to pin 16 on IC1. The preset potentiometer should be soldered last, as it is mounted on the copper side, so that you can adjust it without unscrewing the PC board. If you wish, you could drill a hole in the back of the plastic case, allowing you to make adjustments to this preset without removing the back.

The LEDs can be soldered in now, although it's best to leave them until the PC board is assembled into the



When you have finished assembling the hand control board the two 4.7kΩ resistors and the 10µF capacitor near the cable end must be laid flat, in order to fit into the case.

This is the copper side of the board, after the cable has been terminated. Note the trimpot (VR1) at the top if the board. Leave slack on the cable leads, to avoid any stress. Some of the IC pins are unsoldered; there is no point in soldering unused pins.



The completed hand control board is secured to the top half of the case which must be drilled to accept the meter, the pushbutton switches and the LED indicators. Note that the tops of the LEDs should just protrude through the case.

plastic case. They can then be pushed right into the hole in the case front and their leads soldered.

Now that both boards are finished, you can assemble the hand control.

Hand control case

The meter is mounted on the front of the plastic case (the half with the threaded brass inserts), at the end with the moulded recess on the front. Turn the case over and drill out the two plastic pillars. Start with a drill just big enough to remove the brass thread, then fit a drill two sizes larger and drill out again, repeating until the pillars are removed.

Place the front panel template (Fig.7) on this half of the hand control and mark all the holes. Drill out the pushbutton and LED holes. Make the cutout for the meter either by drilling a series of holes, then cutting and filing the plastic or by using a small coping saw. Finally, drill the two mounting holes for the meter.

Drill a 12mm hole centrally in one of the dark grey end pieces. Remove 100mm of insulation and screen from one end of the 9-way cable and clamp it in the end piece, using the cable clamp, leaving 5mm of the outer covering protruding through.

Mount the control board in the case using the two 10mm metal thread screws and 5mm spacers to hold it in position. Check each button operation, making sure each operates without jamming. If a button is not free to move, slacken the mounting screws and readjust the board position, or ream out the offending hole. When all buttons are operating properly, mark the position of the top mounting hole for the PC board, through onto the front panel. Remove the PC board, drill the hole and countersink it in the front of the case to allow the 2.5mm machine screw to sit flush.

Hold the board so that, when you look at the components, the red button is at the bottom right. Insert both the righthand LEDs into the PC board with the long lead on the righthand side. The lefthand LEDs should have their long lead on the lefthand side. The red LED goes above the STOP button, the green above the FORWARD button, The yellow above REVERSE and the orange above INERTIA.

Replace the control board using the 12mm countersunk screw, 8mm spacer and nut, as well as the metal

Design Philosophy For the Railpower Mk.II

While last month's article gave a comprehensive circuit description, we did not have the space to fully describe some of the operating features, especially as they related to our very popular Railpower design featured in April & May 1988. While that design was very effective, there were a number of features which we would have liked to improve upon but could not, without an excessive amount of extra circuitry. In particular, we have had comments from readers about the following points.

When the Railpower was turned off, it inevitably caused any loco on the track to give a very slight lurch forward. At about the same time, the overload protection buzzer would briefly sound at a low level. This happens because the op amps in the circuit lose control once the supply voltage drops to a very low value. It's a minor problem but a problem that would be nice to solve.

While some examples of the Railpower with infrared remote control came on with Forward selected, most seemed to come on with Reverse selected and while this was easily corrected by pushing the Forward button before pushing the Faster button, again it was something we would have liked to fix.

A more subtle problem involved the minimum speed setting. In order to make the controls more responsive, we provided a minimum speed trimpot and this was set to provide a low voltage across the track so that the locomotive was just on the point of moving. However, with many locomotives, the very narrow pulse output at the minimum speed setting caused an audible buzz. There was no way around this.

In designing the microprocessor version of the Railpower, we were able to address all the above problems without any added circuitry – it was all done in the programming. Hence, when power is first applied, the Railpower controller always comes on with STOP selected. To make the loco go forward, just press FOWARD and the FASTER button until the desired speed setting is obtained on the meter.

The minimum speed buzz problem was solved in the following way. If the train is stationary and Forward or Reverse is selected, then the minimum speed voltage will be applied to the track and the loco will produce a background buzz. However, if the train is stationary and the Stop button is pressed, the track voltage is reduced to zero; the loco will then be totally quiet.

Forward/Reverse protection

In the infrared remote control version of the Railpower (presented in April and May 1992), we added protection against throwing the train into reverse while it was going forward at speed. Normally, if you throw a model train into reverse it is highly likely it will be derailed and that could cause lots of damage to expensive models (if the loco and wagons fall off the layout onto the floor).

In the remote control version of the Railpower, the forward/reverse protection prevented reverse from being selected until the train had been brought down to a very low speed. In the new microprocessor version we have taken a different approach. Now if you press Reverse while the train is going forward, it will come to a stop and then the controller will switch to Reverse. However, it will not move off until you use the Faster button.

That way, the modeller will get a positive response when the Reverse button is pushed, even if that outcome had not really been intended. The train is still protected against damage though. We have taken this alternative approach because some users find it confusing when there is no response to persistent pressing of the buttons. This way, you learn to press the right buttons.

Finally, because the microprocessor allows nothing to happen unless a button is pressed, there is no disconcerting lurch from a locomotive when the unit is switched off and nor does the buzzer sound briefly.

thread screws and spacers, checking the operation of all the buttons again. Once all is OK, push the LEDs forward until they protrude satisfactorily through the front panel then solder all leads of the LEDs.

Cable termination

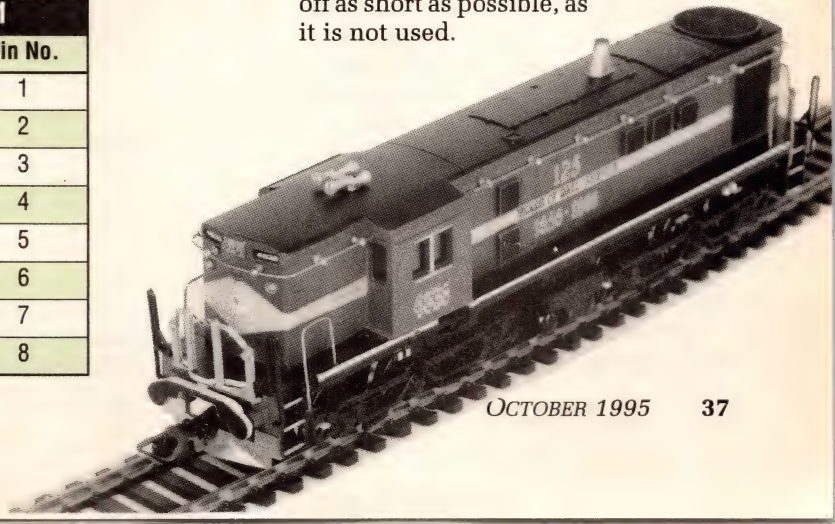
Slide the grey endpiece with the cable into the channels, at the end away from the meter, then cut and solder the wires as detailed in Table 1, leaving around 20mm of slack on each one. The terminations for the wires are marked on the copper side of the board. Pins 1-8, excepting pin 2, are all at one end of the board. Pin 2 is at the other end of the board.

To make it easier to follow, we suggest that, as far as possible, you use the wire colours corresponding to the resistor colour code.

The braid (shield) of the cable should also be connected to the PC board. Cover the braid with a piece of sleeving and connect it to the pad marked B(raid). The cable we used had two green wires so we used the dark green for the termination; the light green wire should be cut off as short as possible, as it is not used.

TABLE 1

Colour	Pin No.
Pink	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8



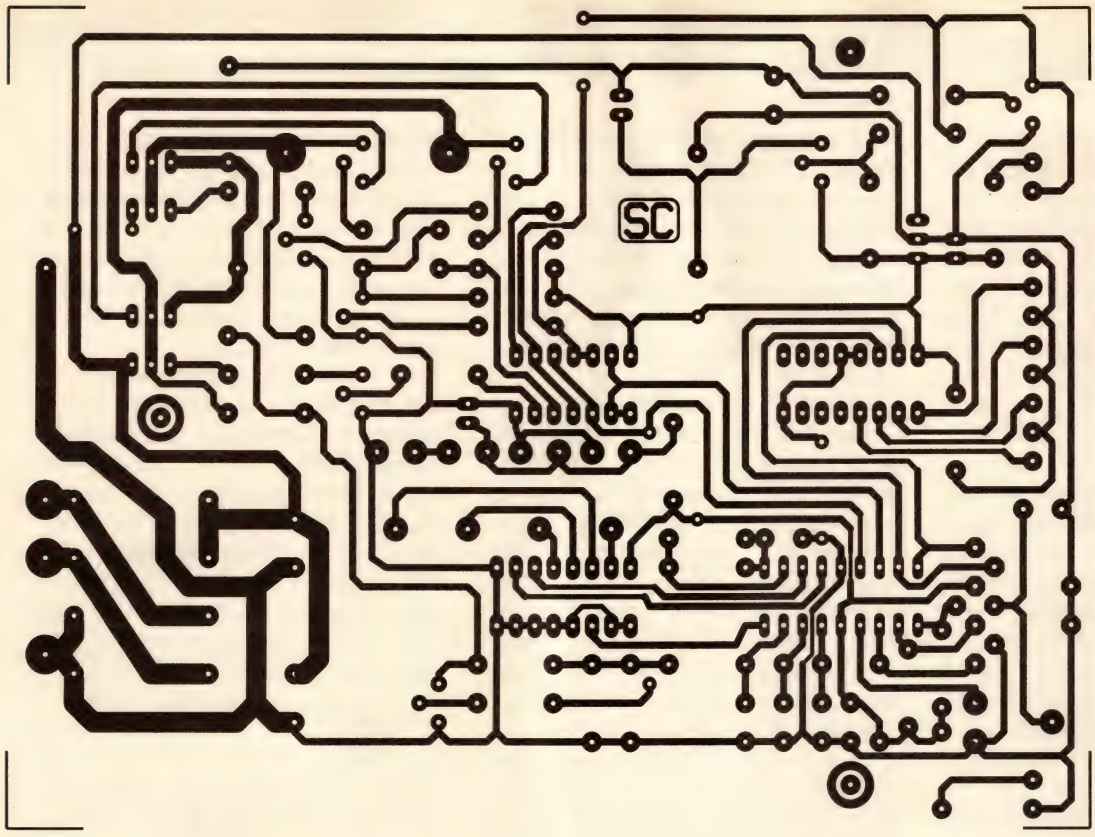


Fig.6: this is the full-size etching pattern for the main PC board. Check your board carefully for etching defects before installing any of the parts.

The Dynamark label can now be affixed to the front panel and the meter mounted. Run two wires from the PC pads marked "meter" to the meter terminals, left pad to left lug, right pad to right lug.

The other end of the cable can now be terminated into the 8-way DIN plug. To prevent the pins moving as you solder them, push the plug into the socket on the main board. Don't forget to slide the outer rubber sleeve of the plug, small end first, onto the cable before you begin!

Cut the insulation and sheath back about 30mm, cut off the light green wire, and using the previous table connect the wire colour to the corresponding pin number. We have shown the pin markings for an 8-pin DIN socket in the diagram of Fig.5 as some DIN sockets do not have the pin markings and even if they do, they can be hard to see even under good lighting.

The braid should be threaded through the hole in one of the clamps that restrain the cable, then soldered. Check the colours against the numbers again, then reassemble the plug.

Testing

Set trimpots VR1 (Inertia) and VR2 (Brake) to mid position. Turn the minimum speed control VR4 to minimum and the maximum speed control VR3 to maximum. Set the Meter adjustment VR5 to centre position. Set trimpot VR1, in the hand control, anticlockwise.

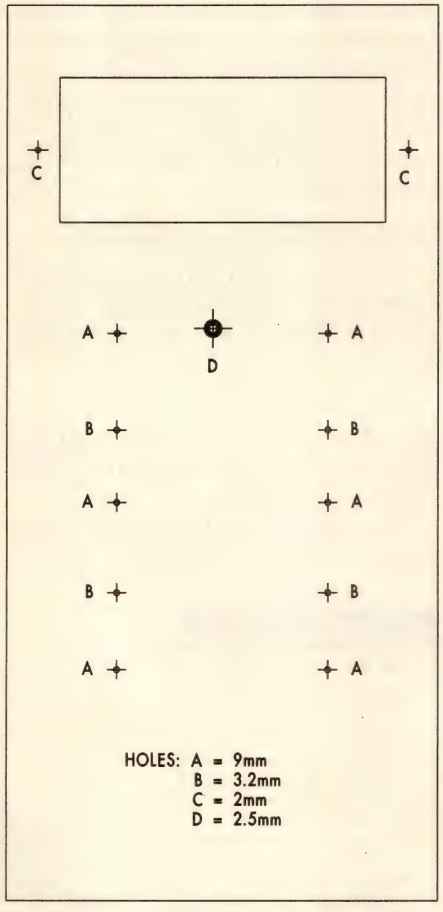


Fig.7: photocopy this diagram and use it as a template when drilling and cutting the holes on the hand control.

Power input to the main board can be from a standard 12V battery charger or from a 12-15VAC model railway power supply. Either way, you connect to the two PC pins on the board marked "AC input".

Plug the hand control into the main board and turn on the power. The green power LED on the main board should light immediately, followed by the red Stop LEDs on main board and the hand control. Pressing the Forward button should extinguish the Stop LED and light the green Forward LED on both units. Pressing Reverse should cause the green LED to go out, the Stop LED to light briefly, then the yellow Reverse LEDs to light.

Hold down the Faster button and the meter should start creeping up the scale. Release the button and the meter should instantly drop back then begin to climb slowly. Press Slower and the meter should jump upscale then creep back as the button is held down.

If everything is working so far, it is

Fig.9: the full-size artwork for the hand control label.

time to test the unit in situ. Turn off the mains power and disconnect the wires from the main board and then mount it in the case. Fit a 5-way insulated terminal block to the back panel, as shown in the photograph, to take the wires for the AC input and track output. Connect the Railpower to your layout and place a loco on it.

Turn on the mains power and the green power LED should come on as before. Pick up the hand control and press FORWARD, then hold FASTER down and if the train moves forward, the polarity of the wires to the track is correct. Note that the train may not move immediately, as the minimum speed preset was set to 0V. If the train runs backwards, swap the wires connecting the controller to the track.

Calibration

It will take a few attempts to get the adjustment of the trimpots to your satisfaction. The minimum and maximum speed trimpots will undoubtedly need resetting several times, as well as those for inertia and brake. As we explained in the circuit description last month, the microprocessor normally only reads the values set on the trimpots when the power is first turned on.

To save you from having to turn the power off and on after each adjustment, it is only necessary to hold down the FORWARD button and then press and release the INERTIA button. This tells the microprocessor to read the trimpot values again. So each time you want to readjust the trimpots, press these buttons to get the new values loaded into the microprocessor's memory. If you readjust the minimum speed it will be necessary to stop the train to make this new value effective.

Once you are satisfied with the trimpot settings, you can calibrate the meter. Slow the train with the SLOWER button until it comes to a complete stop. Adjust trimpot VR1, in the hand control, until the meter's pointer is on zero. Press FORWARD, wait until the green LED lights, then press INERTIA and the orange LED will light. Take the train to maximum speed, then set trimpot VR5 on the main board for a reading of 10 on the meter. There is a small amount of interaction between these two adjustments and it may take several attempts to get them spot-on.

Note that if you change the settings of the maximum or minimum speed trimpots, you will have to recalibrate the meter.

Fault finding

There are two rules to follow if it doesn't go when you turn it on. The first rule is don't panic and the second is don't assume that you have a faulty IC or crook transistor. While it may be a shock to your ego, the most likely reasons why the unit does not work are shorts due to solder splashes on the underside of the board, poorly soldered or unsoldered connections, crossed wires in the DIN connector cable or components in the wrong way. So the first step in rectifying any problem is to very thoroughly inspect your work.

As all the LEDs have been tested, there shouldn't be any problems associated with them. If you wish to check the DIN cable, use a multimeter set to a low Ohms range and check for continuity between each pin and its respective pad on the hand control PC board.

If the green POWER LED does not light you may have a problem with your power wiring or a short on the +5V line. You should have +5V at the output of REG1, at pin 5 of IC1, pin 16 of IC2 & IC4, pin 14 of IC3 & IC1 in the hand control and at Q12's emitter.

If the green LED lights but the red Stop LED does not light at power-on, the first step is to unplug the hand control. Turn the power off, wait for 10 seconds then re-apply power. If it now lights, the problem is most likely in the cable connections.

If all the LEDs light in the way they should when the buttons are pressed, but the loco does not go, then the microprocessor is working and the fault is in the area associated with IC3 or the transistor H-bridge. **SC**

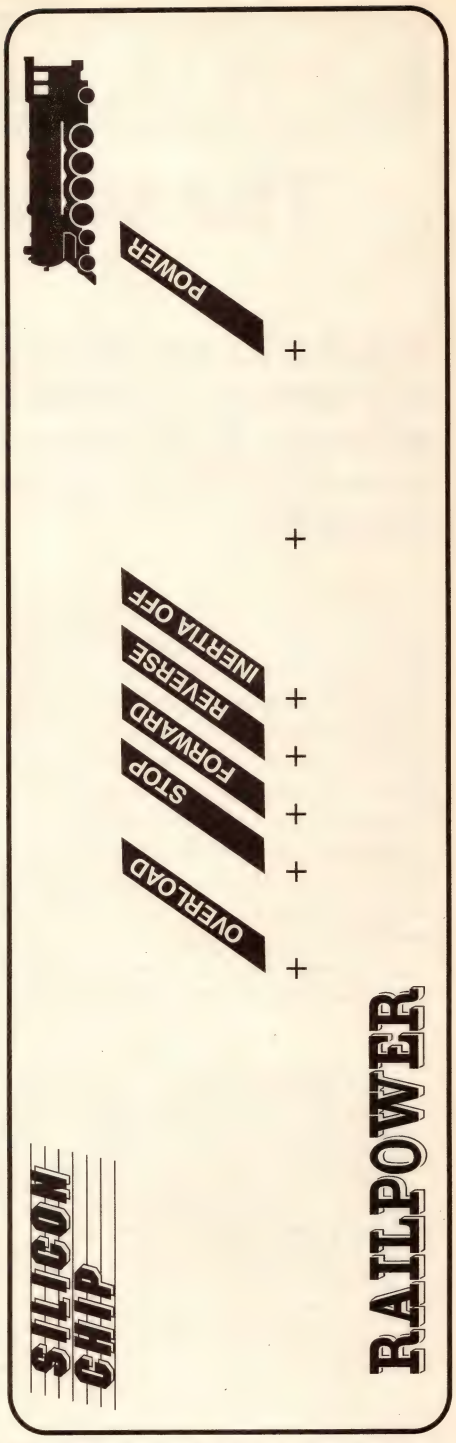


Fig.8: the artwork for the front panel label of the main board case.

SERVICEMAN'S LOG

The view was fabulous, but ...

Yes, there's usually a "but", involving some kind of a trade-off for what looks like a perfect situation. In this case, a location with a fabulous view exacted its own price in terms of appliance reliability.

It really was a beautiful view. This lady customer lives right on a beach front and one would have thought that, with paradise right on her doorstep, she would hardly need a TV set. In fact, she owned a very large double-ended lowboy with an AWA-Mitsubishi SC6341 AS630 chassis.

It was the size of the set that necessitated the house call. And I was going to have to fix it in situ, because I couldn't move it unaided.

The problem was loss of vertical scan, there being just a horizontal line across the screen. I should have realised from the state of the cabinet veneer that the environment may have been to blame.

When I removed the back, the cause was obvious – salt air corrosion. All the tinplate areas were rusty and the aluminium was pitted. Also, the horizontal output transformer didn't look long for this world, with a telltale carbon track on the plastic.

But worse still was the state of a lot of the small components, many of which were green from copper oxide corrosion. Altogether, the long-term reliability of the set looked very poor and I informed the lady of this prognosis. She asked me to see what I could do.

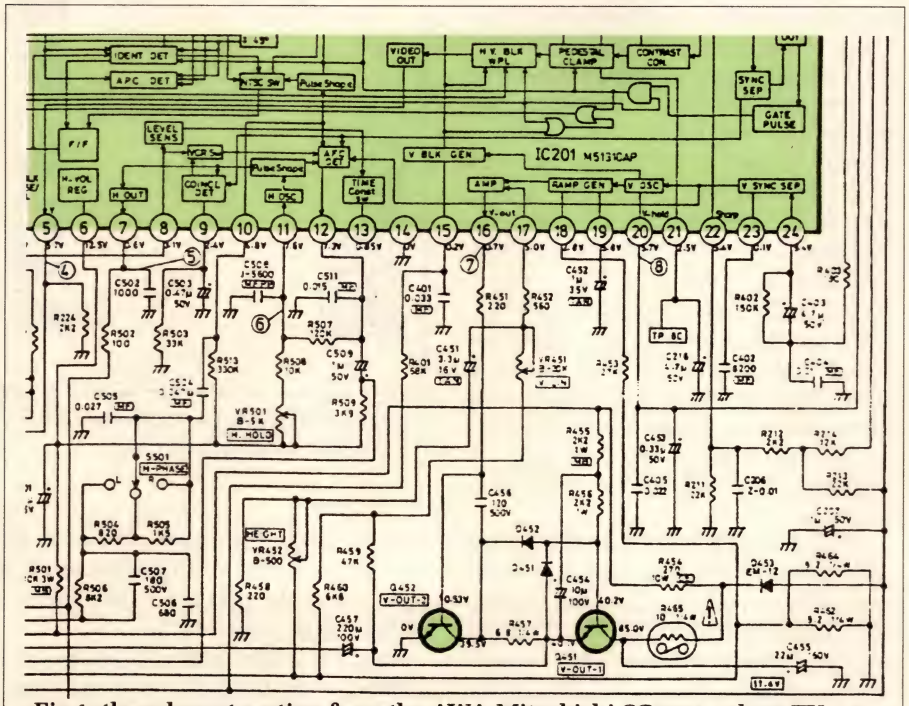


Fig.1: the relevant section from the AWA-Mitsubishi SC6341 colour TV set. The vertical oscillator section of IC201 is shown at top and this drives the vertical output transistors (Q451 and Q452) at the bottom. The height control, VR452, is to the left of Q452.

This chassis is the stereo version of the ML series and most of the deflection circuits are the same. The vertical timebase is fairly simple in terms of component numbers – a 48-pin IC (IC201) carries the vertical oscillator and drives the two output transistors (Q451/Q452). The correct value of 11.4V was applied to pin 33 of the IC but the collector of Q451 had 113V on it, instead of around 65V, suggesting the transistors were switched off and not being driven.

Sometimes these circuits can be difficult to service, as it is often a chicken and egg situation, where a fault in any section, including the feedback path, can stop it from working. In this situation, it is hard to know where to start, especially as I didn't have the CRO to turn to. But as luck would have it, the problem was fairly obvious from the state of the height control (VR452) which was badly corroded.

I tried to adjust it while watching the screen. Impossible – the cabinet was too large; I had to ask the lady for some help. She was able to tell me that the horizontal line had expanded and was trying to fill the screen as I adjusted the control; that is, until the control disintegrated.

I replaced it and the picture was restored. I then refitted the back and was going through a final check when I noticed that the stereo lights were not on and the sound was in mono. This was all I needed to remove the back again.

This set uses the TDA3800G decoder and that was my initial suspect. However, I had blamed this unit unfairly on a previous occasion, so I looked around for another possible cause. The preset pots VR301, VR302 and VR303 caught my eye; they all

looked bad. But replacing them presented a problem because I didn't have any alignment equipment with me. I took a punt and used an indelible felt tip marker to mark the positions of the wiper arms and then replaced all three controls.

Fortunately, only VR302 and VR303 were the culprits and, by setting the wipers at the same angle as the originals, full stereo sound was restored and the LEDs were alight. I finally emptied half a can of CRC 2-26 all over the corroded areas and the horizontal output transformer, then I wiped and cleaned off the excess and dirt with a cloth.

After replacing the back I had a word with the lady on how best to protect the set, at least for a while. I suggested she move it away from the open window overlooking the sea and place it as far as possible on the other side of the room, or even in another room on the other side of the house.

Also, I recommended that she cover the set with a sheet, blanket, or even a plastic tarp when she wasn't watching it, especially during any humid weather or when onshore winds prevailed. She compromised by covering it with a table cloth away from the window and as far as I know it is still working, six months later.

But, as I said earlier, there was a price to pay for that fabulous view.

The red face

My next story involves a video recorder that bounced. Anything that bounces has the makings of a red face situation and this was no exception. But there is a twist to the story.

It started when a new lady customer brought a Philips VR6448/75 video recorder into the shop and complained that it chewed the tape on ejecting – sometimes. She added that she used the machine a lot and would appreciate it if I could fix it as soon as possible.

It so happened I wasn't particularly busy that day, so I tackled it almost immediately. The intermittent aspect didn't help. It took about 10 tries to create the fault, whereupon it became fairly obvious; the tape wasn't being fully wound back into the cassette prior to unloading, leaving a length of tape outside to be chewed up by the ejecting action.

This turned out to be a partial failure of the reel idler assembly. I removed this, cleaned and tested it, replaced it, and tested it again. I then checked the idler shaft and found it to be sticking.

It didn't respond to normal treatment and so I decided to fit a new idler assembly and a set of belts and tyres. This machine is made by Sharp and so I rang the lady and quoted her on the basis of Sharp replacement parts. This worked out at $135.00 – $52.50 for the parts and $82.50 for labour. She accepted quite happily and I told her it would be ready that afternoon. I fitted everything back in, cleaned the heads and the machine generally, tested it, and was quite confident that it was in perfect condition.

The lady collected the machine later in the day, paid by cheque, and thanked me for being so prompt; another satisfied customer, or so I thought.

A real blast

About three weeks later, I answered the phone one morning and a bloke identified himself as being from one of the local TV stations. And without waiting for any acknowledgement, he let fly with "what sort of guarantee do you give?" Then, again without waiting for an answer, he went into a long diatribe about how I had ripped him off and that I didn't know what I was doing. What's more, he demanded that I should immediately call at his place and fix his recorder properly. And he added that the technicians at his station could have fixed the recorder properly at half the outrageous price I had charged (I wondered why he hadn't used them).

I'm afraid the strength of his blast caught me off guard and, initially, I couldn't get a word in edgeways to even identify the recorder. I did eventually and, of course, it was the lady's husband, But even then, it was an effort to find out what the problem was. All he would say was, "It's doing the same thing – it won't eject" (which wasn't the same thing).

When he finally paused for breath I told him that my warranty was 90 days for the parts I had used and for my work; nothing else. I invited him to bring the recorder back in and I would look at it immediately. That wasn't good enough – I had to drive out and fix it.

I baulked at that and repeated my offer to check the machine but only in my workshop. "Right", he said, "I'm going to go through you like a packet of salts". And he hung up.

...I INSISTED THAT HE WAIT WHILE I EXAMINE THE MACHINE IN FRONT OF HIM...

The "packet of salts" took the form of a call, shortly afterwards, from Consumer Affairs, acting on a complaint from him that I wasn't prepared to fix his recorder. The C.A. man was strictly neutral and listened politely while I gave my side of the story and explained that I would attend to the matter as soon as the recorder was brought back. He said he would relay that to the complainant.

Another week went by, a somewhat worrying period. No-one likes a repair to bounce, for whatever reason. While I was sure I had done a thorough job, there is always the risk of something being overlooked. But, try as I might, I couldn't think what.

Then he appeared, carrying the recorder. He was a lot quieter now – doubtless on the advice of the C.A. man – and was even polite, in a very reserved manner. I tried to be equally polite. He offered to leave the recorder with me and call back later. But I insisted that he wait while I examined the machine in front of him, to which he reluctantly agreed.

I plugged the recorder in and confirmed the nature of the fault; a cassette was stuck inside and wouldn't eject. I could hear the motors trying to turn but without result. It was clearly not the original fault.

I removed the covers while he watched and began to turn the eject shaft gently by hand. And as the cassette lifted clear of the deck floor I experienced a wave of relief as I saw the cause of the problem. And it was simple enough for even the customer to see and understand – a ballpoint pen jammed underneath it.

Talk about a red face – his reserve collapsed totally. To give him his due, he did apologise and said he would contact Consumer Affairs and put that right. But he didn't offer to pay for having it fixed again. I had to realign the ejector assembly with the loading motor mode select switch, to restore the correct sequence. And I tested it to his satisfaction while he waited.

Technically, I could have charged him again. But I wasn't going to push it – honour was satisfied.

J. L.'s video camera

And now, on a completely different theme, I have a quite unusual story from my southern colleague, J. L. of

Tasmania. Here's how he tells it.

I've had a very interesting job over the last few days. It was the sort of job that usually goes only to specialist technicians, so I'll tell it here as a word of warning to others who might get involved and as a gesture of thanks to the highly skilled technicians who helped me out of my trouble.

It concerned my own video camera, a Panasonic model NV-MS4A. It's a full-size Super VHS camera, a big, heavy thing that produces superb pictures. Or at least, it did until my son gave it a hefty thump while out filming one day.

As far as he can recall the camera was in its fitted case when the thump occurred and there is no sign of damage on either the case or the camera. But in fact, the camera had suffered internally and would not work next time he tried to shoot.

The deck would not load or unload a tape but had stopped half way through one or the other process. However, it did eject the tape and a mangled S-VHS cassette was the result.

Next day, I took it to the local Panasonic specialists for repair. I was over optimistic because, as it turned out, they had three weeks work on hand and could not help me for at least that long. And I needed it before that. "Why not do it yourself?" they asked. "You've done plenty of VCRs and this is only a more compact version of the same thing!"

Well, I had a manual for the camera and they offered to make available some vacant bench space and promised moral support, so I set to work.

First, I removed all the screws as per the manual. There were about 17 of them altogether and I expected the camera covers to more or less fall off. Alas for my high hopes! I pulled and tugged and pushed and prodded for 20 minutes but couldn't get the thing apart. I worked so hard that I feared I might break the plastic panels but nothing I could do would expose the inside of the camera.

Then their senior camera technician came over and said, "Here! What are you doing? You'll smash the thing, handling it like that!" And with that, he poked a small screwdriver in through a couple of holes in the cover and both sides simply fell off!

It seems that Panasonic designed this camera to a "belts and braces" standard. Not only are the covers held on with lots of screws, they are also held in place with plastic clips moulded into the inside of each half shell. Provision is made for pushing the clips out of the way to release the shells but no mention is made of this in the manual.

You have to find out for yourself, or be shown, where these clips are before you can open the camera. One could smash the thing to pieces trying to get it open but once the secret is known, disassembly is quick and almost painless.

Now that the mechanism was exposed, it was easy to see what had happened. A pin on a lever, intended to ride in a groove on the master cam, had jumped out and was sitting jammed on the top surface of the cam. It was easy enough to slip the pin back into the groove but this left the mode switch and mechanical timing way out of place.

I struggled with gears and levers, trying to get everything back into position but I was getting nowhere. The mechanical instructions in the manual I was working from were written in excruciating Japanese English, so I had to ask for help from one of the other technicians. He is a better interpreter than I (or else, he has been through all this before) and he soon had everything back into place and the mechanism working properly.

I reassembled the camera, refitted the covers and tested the unit to my satisfaction. It was the first time I had ever been inside a camcorder and I came away thinking that it was not a place in which I would like to spend too much time. Apart from anything else, my fingers are too thick and too insensitive to handle the tiny parts.

It's not fixed yet

Now, if you think that this is the end of the story, you're wrong. It's only just begun.

I used the camera that weekend and shot some perfect footage. Then my son took the camera on the Monday and that evening complained that it would not record in colour and had a red line down the righthand side of the picture. He felt it might be a physical problem since the camera seemed to work reasonably well when handheld but played up when mounted on the tripod.

We soon found that we could make the fault come and go by pressing

KALEX
The UV People

ETCH TANKS
● Bubble Etch ● Circulating

LIGHT BOXES
● Portuvee 4 ● Portuvee 6
● Dual Level

TRIMMER
● Ideal

PCB DRILL
● Toyo HiSpeed

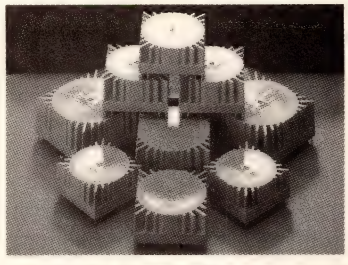
MATERIALS
● PC Board: Riston, Dynachem
● 3M Label/Panel Stock
● Dynamark: Metal, Plastic

✳ AUSTRALIA'S NO.1 STOCKIST ✳

KALEX
bankcard VISA
40 Wallis Ave, East Ivanhoe 3079.
Phone (03) 9497 3422, Fax (03) 9499 2381

TRANSFORMERS

• TOROIDAL
• CONVENTIONAL
• POWER • OUTPUT
• CURRENT • INVERTER
• PLUGPACKS
• CHOKES



STOCK RANGE TOROIDALS
BEST PRICES
APPROVED TO AS 3108-1990
SPECIALS DESIGNED & MADE
15VA to 7.5kVA

Tortech Pty Ltd
24/31 Wentworth St, Greenacre 2190
Phone (02) 642 6003 Fax (02) 642 6127
bankcard VISA MasterCard

lightly on the side of the camera body, in the vicinity of the main PCB. It was as well that I'd learned the secret of the plastic clips because I was going to have the covers on and off many times over the next few days.

With the main PCB exposed, I found that the fault did indeed respond to gentle pressure but only on one end of the board. It was obviously a dry joint but on a 100 x 150mm double sided board, thickly coated with micro-miniature surface mount components, I didn't like my chances of finding it.

The fact that the fault seemed only to affect the chroma circuits helped to reduce the area of confusion but, even so, it involved hundreds of tiny components on both sides of the board.

I used a fine dental pick to gently prod and poke all the components I could identify as part of the chroma circuitry. The PC patterns are given in the manual but only the larger and less crowded components are listed. Dozens of chip resistors and capacitors are simply not shown on the pattern, which makes identifying the various parts rather difficult.

Several times I poked at a component and the fault disappeared. Whenever it stayed "disappeared", I hoped that I might have cured the problem by accident and so reassembled the camera and gave it a test run.

This went on half a dozen times before I realised that, by myself, I would never be able to solve the problem. In the absence of more precise information about the exact nature of the fault and therefore its physical location, I could hunt forever and never track it down. So it was back to my friends at the service centre.

I played back some of the test tape I had been running and their senior technician said straight away "that's a delay line fault!" When I demonstrated that it could be turned on and off by pressing on the board, he opined that it had to be a dry joint on one or another of the delay line pins.

It seems that it was the red line down the righthand side of the screen that suggested to him that this was a delay line fault. As it turned out, he wasn't wrong.

I had quite a difficult job finding the delay line. In fact, there are two in the camera, one a 1H line and the other a 2H. Neither looks anything like a conventional TV delay line. The 1H line is in an 8-pin IC package, similar to but smaller than a 555 timer chip. The 2H delay line looks like another IC but is in a 16-pin package.

Once I had identified the delay lines, I was able to examine them for signs of dry joints. This was rather inconclusive since, under a strong glass, the solder looked rather crystalline but no more so than hundreds of other joints on the board.

Still, I had been assured that at least one of the 24 pins on these two chips had to be loose, so I fitted the finest point into my soldering iron and gave each one a touch of heat. And that was all it took. The fault disappeared and has not returned.

I haven't been able to learn if my friend solved the problem using experience or theory. Chroma delay line problems are so rare that I have never had one in all my years of servicing colour TV sets or video recorders. They are not unknown, of course, but are so unusual that few people build up a fund of experience.

Minor hassles

The job wasn't quite over since I had no end of trouble getting everything back into place. I misaligned a 30-pin plug and socket connector and had the whole machine reassembled before I found that the camera section wasn't working.

Then, when I fixed that, there was no servo control because a 30-pin flexible connector had slipped out of place. Then the zoom lens wouldn't work, because I had somehow dislodged its tiny 3-pin plug in the process of replacing the side cover!

It's been an interesting experience but I have never been so pleased to complete a job. I would never have undertaken the task if the camera had not been wanted urgently. I think my friends at the service centre are entitled to every penny they make from camera repairs.

Thanks, J. L., for a most interesting and unusual story. It just goes to show that you never know what you can do until you try. **SC**

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

OCTOBER DEALS FROM JAYCAR

NOISEBUSTER

Personal Active Noise Reduction Headphones

As seen on Beyond 2000

1994 winner "The Discover Awards" for technological innovation

NEW

THESE HEADPHONES ARE AMAZING!!! They not only produce good quality audio sound like normal headphones, they REDUCE outside noise.

HOW DO THEY WORK?

The stereo headset features two microphones that continuously sample background noise. The data is fed into a high speed processing chip, which signals the headsets speakers to generate noise thats the exact mirror image of the offending waveform. The two waveforms cancel each other out. They are designed to cancel the most irritating monotonous drones, from lawn mowers and leaf blowers to aeroplanes and truck engines to air conditioners and computer fans etc. And because the NOISEBUSTER is tuned to erase only sounds in the 30-1200Hz range, you can still clearly hear voices and sounds around you. For example - in aircraft, they will eliminate up to 95% of cabin noise, and you can listen to the movie or radio programs. Use with or without music.

HOW EFFECTIVE IS NOISEBUSTER AGAINST SPECIFIC NOISE?

•Aircraft cabin noise: up to 95% reduction •Automobile: up to 80% reduction •Train/subway: up to 70% reduction •Lawn mower: up to 60% reduction

The best way to convince yourself how good these really are - is to call in to any Jaycar store and try them! You will be as amazed as we were!

Cat. AA-2000 **ONLY $149**

Jaytech Fast Ni-MH Battery Charger

Features:

•Charges 2 or 4 pcs AA or AAA rechargeable Ni-MH batteries •Fast charge - 5 hours •LED lamp indicates fast charge and trickle charge •Built in safety temperature sensors to avoid the battery from damage by overheating •Built in IC timer control •Auto selects the correct charge rate for AA or AAA •Plugs directly into 240V mains power point •Electricity authority approved.

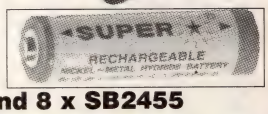
SPECIAL OFFER

NEW

Cat MB-3509 $39.95

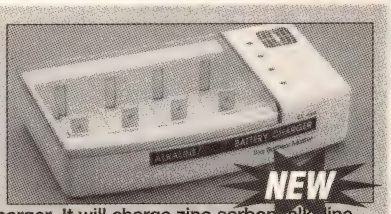
1.1A NI-MH AA BATTERIES

$5.95ea Cat. SB-2455



Buy the MB-3509 charger and 8 x SB2455 batteries for only $79.95. SAVE $7.60

Alkaline Battery Charger



NEW

BRAND NEW MODEL

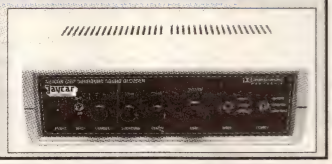
Prolong the use of your alkaline and zinc carbon batteries with the new "Battery Master" intelligent charger. It will charge zinc carbon, alkaline and nicad batteries in sizes AAA, AA, C and D. It will charge four at a time. The Battery master has a built in microprocessor which monitors the charging of each battery. A tri colour LED for each battery shows you the state of charge. LEDs are green when plugged in. A red LED indicates either a battery has been incorrectly inserted or is too old. Amber LED indicates charging is in progress and a green LED shows batteries are charged. SAVE MONEY AND HELP THE ENVIRONMENT!!! AC adaptor is extra. Requires 9VDC 500mA. Use an existing one or purchase cat MP-3008 9VDC 800mA $22.95.

Cat. MB-3525 **$49.95**

DOLBY PRO LOGIC KIT FOR UNDER $200!!

DOLBY SURROUND PRO • LOGIC

Yes, you can now buy the Dolby Pro Logic short form kit (KC-5175) and the enclosure kit (KC-5176) for $199.



SAVE $40 $199

DOLBY PRO LOGIC CENTRE SPEAKER KIT BARGAIN

Kit includes:

•2 x 5" shielded woofers Cat CW-2102	Value $79.90
•1 x 1" shielded dome tweeter Cat CW-2006	$16.95
•1 x crossover network Cat CX-2613	$8.50
•1 x set box plans / wiring details	$105.35

Only $89 SAVE OVER $16 Cat. CS-2500

8" SUBWOOFER SALE

Quality Max Sound woofer. Similar to models used in EA's subwoofer article in June 92. The specs have changed slightly. Recommened vented box size 44 litre. Sealed box size 35 litre. See 1995 cat P43 for full details and specs.

•Impedance 8Ω

•Power 80WRMS

CAT PRICE $99.50

SAVE AN AMAZING $40

Cat. CW-2150

Oct Price $59.50

SAVE ON 24V TO 12V REDUCERS

3 AMP UNIT

Cat Price $49.95

Oct $42.95

Save $7 Cat. MP3058

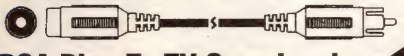
7 AMP UNIT

Cat Price $92.50

Oct $79.50

Save $13 Cat MP3060

FREECALL FOR PHONE ORDERS 008 022 888



RCA Plug To TV Coax Lead

•1.25 metres **CAT PRICE $2.95**

CAT AV-6590

Only $1ea

JAYCAR OPENS IN PERTH

326 NEWCASTLE ST

NORTHBRIDGE

PH: 09 328 8252

FAX: 09 328 8982

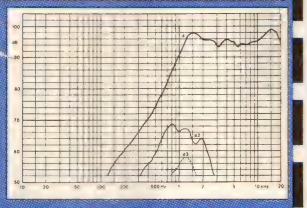
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

PHILIPS DOME TWEETER DISTRESS PURCHASE!!!

YOUR CHANCE TO SAVE $$$. We've made a scoop purchase of some Philips AD11400/T8 1" Hi Fi Dome Tweeters. These are physically slightly smaller than our standard AD11610 tweeters but cost exactly the same price to buy from Philips. Grab some while we have them.

SAVE A FORTUNE



Specifications: •Impedance: 8Ω •Voice coil resistance: 6.3Ω •Resonant frequency: 1500Hz •System power handling: 100WRMS •SPL: 90dB/1m •Voice coil diameter: 25mm •Magnet weight: 100g •Size: 82 x 82mm, cutout hole 73mm

Cat. CT-2014 NORMAL PRICE IS AROUND $26

THIS LOT ONLY $16.95ea or 10 FOR $139

SAVE ON ITACHO CAR ALARMS

Ultra Reliable Remote Control Car Alarm
Cat. LA-8900

SAVE $$$

DEAL ONE

Car Alarm	$139.50
Siren	$25.95
TOTAL	$165.45

Buy Both For $139.50 Save $25.95

DEAL TWO

Car Alarm	$139.50
Battery Backup Siren (LA-8910)	$64.95
Total	$204.45

SAVE $34.95

Buy Both For $169.50 Save $34.95

ADD CENTRAL LOCKING

DEAL THREE

Car Alarm	$139.50
Siren (LA-8908)	$25.95
4 Door Central Lock Kit (LR-8830)	$95.00
Total	$260.45

SAVE $40.95

Pay Only $219.50 Save $40.95

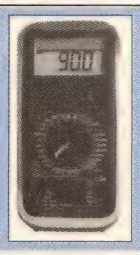
DEAL FOUR

Car Alarm	$139.50
Backup Siren (LA-8910)	$64.95
4 Door Central Lock Kit (LA-8830)	$95.00
Total	$299.45

SAVE $49.95

Pay Only $249.50 Save $49.95

BRYMEN METERS



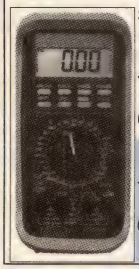
OCTOBER Free Inductive RPM Pickup with each purchase of 323 or 328. Cat QM-1455 Value $32.95

323 Automotive

•Duty Cycle •RPM •Dwell Angle •DCV •DCA •Ohms

Cat. QM-1440 **only $159**

328 Automotive



323s features plus: •Temperature •MS Fuel Injection DET •Throttle Body Injector •Fault Code Det •Alternator Tester •Plus More

Cat. QM-1450 **$239**

OCTOBER Free Pocket DMM with 837 purchase. Cat QM-1520 Value $34.95

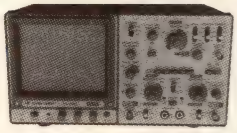
837 True RMS

Too many features to list - see catalog

Cat. QM-1460 **$399**

CRO DEALS

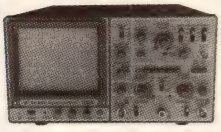
25mHz Dual Trace CRO



1 YEAR WARRANTY

Cat. QC-1900	$749
Free - 2 Probes QC-1902	$79
Free - Select any goods to the value from our product range	$50
Pay Only $749	TOTAL $878

50mHz Dual Trace



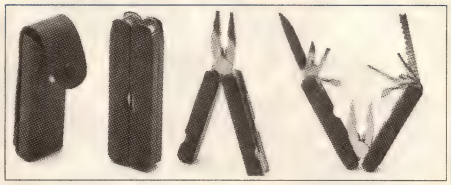
Cat. QC-1910	$1195
Free - 2 Probes QC-1902	$79
Free - Select any goods to the value from our product range	$100
Pay Only $1195	TOTAL $1374

NEW JAYCAR DEALERS

NSW	
Parkes - Computing Outwest	068 623 366
Tamworth - Bourke St Electronics	067 664 664
The Entrance - Home Tech Centre	043 329 898
Wagga - Philips Electronics	069 216 558
VICTORIA	
Bendigo - PCB Electronics	054 432 157
Morwell - Centrix Computers	051 336 633
SOUTH AUSTRALIA	
Mt Gambier - Hutchessons Commun	087 250 400
NEW ZEALAND	
Putaruru - Zap Electronics	07 883 3055
FIJI	
Lautoka - All Systems Electronics	666 009

This Is Not A Leatherman!!!

But is nearly as good and costs only a fraction of the price!!!



Don't know what a Leatherman is? This pocket multitool when folded looks like a pocket knife. Simply open it up, and fold the unit back on itself to reveal a pair of pliers. There is also some typical pocket knife attachments, which include: •large knife •small knife •bottle opener •slot screwdriver •Philips head screwdriver •can opener •file. Supplied in a black case with belt clip for easy carrying. Folded size: 100(L)x30x20mm.

NEW

Cat. TH-1900

LEATHERMAN SELLS FOR AROUND $110.00

OUR TOOL IS ONLY $19.95

UHF TV ANTENNAS

Thousands Sold. About 1/2 the price of others. See 1995 catalogue page 96.

23 Element	43 Element	91 Element
Cat. LT-3178 $31.50	Cat. LT-3181 $41.50	Cat. LT-3182 $72.50

4" 8Ω Speaker

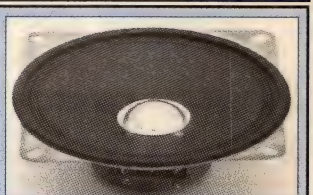
These wont last. Power handling 2.5W.

Cat. AS-3009

Normally $3.95

OCTOBER PRICE $2

Save $1.95



BUY 10 LESS 10%

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

Jaycar vifa

*FREE GOLD Speaker Stands For October

*Cable with JV20's

Assemble your own speaker kits using quality European VIFA drivers and save a fortune. Cabinets and crossovers are prebuilt. Simply screw the speakers in and solder the leads. See our 1995 catalogue for full details. Call into any store for a demo.

*Two sets of Gold Speaker Stands FREE (value $60) with JV40/JV60/JV100 speakers and cabinets purchase . *One set FREE (value $30) with JV80/JV110

Quote from Leo Simpson Silicon Chip On JV100's
This speaker really performs, with prodigious power handling and beautiful bass down to below 30Hz. But as well as power handling and extended bass response the system is very satisfying in its handling of all types of music with a smooth midrange and very clean treble reproduction.

JV80 8" Subwoofer

Refer EA June 1995

Speaker Vifa M22WR CW-2115	$199.50
Polyswitch Cat RN-3472	$10.95
Cabinet Cat CS-2540	$139.00
TOTAL	$349.45

JV40 5" Three Way Speaker Kit

Refer EA September 1995

SPEAKER KIT
Cat CS-2570 $489/PR
WITH CABINETS
Cat CS-2572 $699/PR

JV60 6" Three Way Speaker Kit

Refer SC August 1995

SPEAKER KIT
Cat CS-2560 $579/PR
WITH CABINETS
Cat CS-2562 $849/PR

JV100 10" Three Way Five Speaker Kit

Refer Silicon Chip October 1995

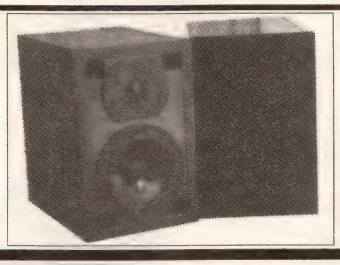
SPEAKER KIT
Cat CS-2550 $1199/PR
WITH CABINETS
Cat CS-2552 $1499/PR

JV20 2 Way Shielded Speaker Kit

FREE WITH $478 DEAL - 10 METRES OF MONITOR OFC SPEAKER CABLE Cat WB-1735 Value $39.50

Refer EA July 1995

SPEAKER KIT Cat CS-2580 $169.50/EA
WITH CABINETS Cat CS-2582 $239/EA - $478.00/PR



JV110 10" Subwoofer

SPEAKER - Vifa M26WR

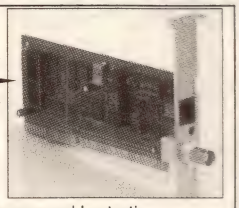
Cat CW-2118	$229.50ea
POLYSWITCH RN-3472	$10.95ea
CABINET Cat CS-2552	$149.00ea
BAFFLE Cat CS-2556	$30.00ea
TOTAL	$419.45ea

JAYCAR FOR ETHERNET

ETHERNET LOCAL AREA NETWORK CARD

NEW

ISA 2 in 1 Ethernet network interface cards (BNC and RJ-45 connectors). Novell NE2000 compatible Netwave ODI/IPX, NDIS & packet drivers. Bus width: 8/16 bit ISA, auto detection RAM buffer: 8/16K/bytes. Jumperless software configuration and hardware automatically detects media type. Ideal for Netware, Windows for Workgroup and Lantastic.

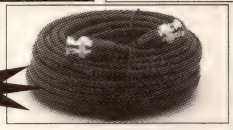


Cat. XC-4650 **was $79.95 NOW $69.95**

ETHERNET NETWORK CABLES WITH BNC PLUGS EACH END

5 metres Cat. PL-0938 $9.95
10 metres Cat. PL-0937 $16.95

NEW



CONNECTORS

BNC 50Ω Terminators	Cat. PP-0655	$3.95
BNC "T" Connector	Cat. PA-3662	$5.95
BNC Crimp Plug	Cat. PP-0649	$2.80
Boot For PP0649	Cat. PM0648	$1.25
"F" Connector double female	Cat. PA-3662	$5.95

MAKE YOUR OWN LEADS

50Ω Cable	Cat. WB-2010	$0.85m $60/100m
Crimping Tool	Cat. TH-1880	$39.95ea

CD ROM

NEW

Dual speed Japanese made CD ROM. 12 month warranty. Suitable for use with any IBM compatible machine. Supplied with CD ROM drive disk, leads and instructions.

Cat. XC-4625 **NOW $159 SAVE $40**

3.5" 1.44M Floppy Disk Drive

Quality brand
12 MONTHS GUARANTEE

Cat. XC-4620 **WAS $79.95**

NOW $69.95 SAVE $10

MICROPROCESSOR BARGAIN

NEW

INTEL P8086-2 16 bit HMOS CPU, 5mHz clock, 40 pin device, DIL.

Cat. ZZ-8510 **5 for $5**

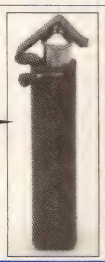
PROFESSIONAL ADJUSTABLE WIRE STRIPPER SELLOUT

NEW

Quality tool ideal for stripping coaxial cables. Will either strip in a circular motion or slice the sheath side ways. Simple cutting depth adjustment. If you strip a lot of cables, this tool is a must for your toolbox.

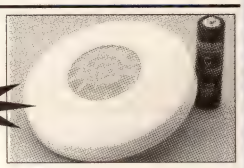
Cat. TH-1822 WAS $24.95

NOW $14.95 SAVE $10



360° Ceiling Mount Pulse Count PIR

NEW



Attractive slimline design giving 11 metre radius at 3.6m ceiling height - much easier to mount in certain situations, and cables can be easily run through house ceilings instead of down walls. •Operating voltage: 8 to 16VDC •Current draw: 15mA •Output: NC contacts •Tamper: NC •Pulse count: 1 or 2 selectable.

DONT PAY $69.95

Cat. LA-5020 **only $49.95**

AYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
AYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
AYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

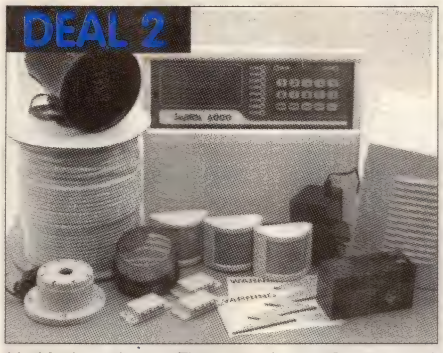
HOME BURGLAR ALARM DEALS FROM JAYCAR

Protect Your Home For Under $200

You won't beat this deal anywhere. Checkout what our opposition have available for $249!!! All you need is a bit of labour and you have a reliable affordable alarm that offers you piece of mind.

INCLUDES:	NORMAL PRICE
1 x 4 sector Jaytech panel	$109.50
2 x Jaytech pulse count PIRs	$59.90
1 x mains power supply	$21.50
2 x reed/magnet switches	$11.50
1 x siren horn	$24.95
2 x deterrent stickers	$4.00
50 m of 4 core alarm cable	$28.00
NORMALLY PAY	$259.35

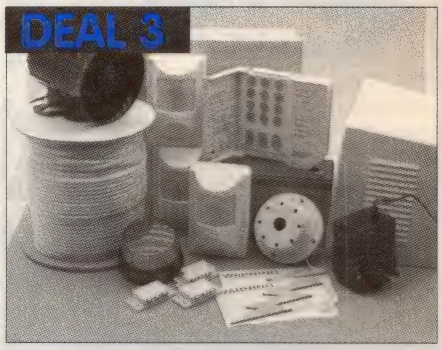
Cat. LA5450 Pay Only $199



Ideal for larger homes. This system has our 6 sector panel and includes everything that a professional alarm installation company would install and charge around 800-$1000. Save a fortune by doing it yourself.

INCLUDES:	NORMAL PRICE
1 x 6 sector Jaytech panel	$139.50
1 x mains power supply	$21.50
1 x 1.2Ah backup battery	$28.50
3 x Jaytech pulse count PIRs	$89.85
3 x reed/magnet switches	$17.25
1 x strobe	$19.95
1 x metal siren cover	$28.95
1 x siren horn	$24.95
1 x internal siren	$19.95
2 x deterrent stickers	$4.00
100 m of 6 core alarm cable	$88.00
NORMALLY PAY	$482.40

Cat. LA5455 Pay Only $349

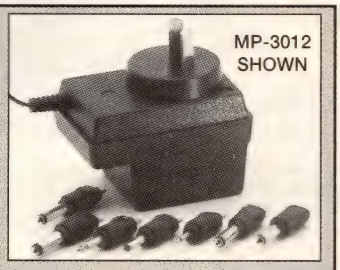


This system inculdes the brand new DSC 5 sector alarm panel with Austel Approved dialler. Connect it to an alarm company or it can phone you or your neighbours etc.

INCLUDES:	NORMAL PRICE
1 x DSC 5 zone alarm/dialler	$279.00
3 x Bellmate 100 PIRs	$119.85
1 x mains 3 wire power supply	$24.95
1 x 6.5Ah backup battery	$43.50
2 x reed/magnet switches	$11.50
1 x strobe	$19.95
1 x metal siren cover	$28.95
1 x siren horn	$24.95
1 x internal siren	$24.95
2 x deterrent stickers	$4.00
100 m of 6 core alarm cable	$88.00
NORMALLY PAY	$669.60

Cat. LA5460 Pay Only $599

Jaycar Has All Your Plugpack Requirements



- **12VDC 150mA.** With 7 reversable plugs — **Cat. MP-3002** $11.50
- **9VDC 150mA.** With 7 reversable plugs — **Cat. MP-3003** $11.50
- **12VDC 450mA.** With 7 reversable plugs — **Cat. MP-3006** $15.50
- **9VDC 300mA.** With 2.5mm DC plug — **Cat. MP-3007** $15.50
- **9VDC 800mA.** 2.1mm reversable DC plug — **Cat. MP-3008** $22.95
- **3, 4.5, 6, 7.5, 9 & 12VDC 300mA** Supplied with 7 reversable plugs — **Cat. MP-3010** $19.95
- **3, 4.5, 6, 7.5, 9 & 12VDC 500mA** Supplied with 7 reversable plugs — **Cat. MP-3012** $24.95
- **12VDC 1 amp.** With 7 reversable plugs — **Cat. MP-3015** $22.95
- **3, 4.5, 6, 7.5, 9 & 12VDC 1 amp.** Supplied with 7 reversable plugs — **Cat. MP-3016** $29.95
- **12VAC 500mA.** 3.5mm DC reversable plug — **Cat. MP-3020** $16.95
- **16VAC 1.25 amp** With bare ends — **Cat. MP-3021** $21.50
- **17VAC 1.5 amp** - earth connected (Austel approved for use with alarm diallers. Terminates to bare ends — **Cat. MP-3022** $24.95
- **10VAC 1 amp.** Terminates to 2.1mm reversable DC plug — **Cat. MP-3025** $21.50
- **12VAC 1 amp.** Terminates to 2.5mm reversable DC plug — **Cat. MP-3026** $21.50
- **Regulated 3, 4.5, 6, 7.5, 9 & 12VDC 500mA** With 7 reversable plugs — **Cat. MP-3030** $29.95

BULK USERS - CONTACT OUR WHOLESALE DEPT. FOR AMAZING PRICES

Plastic "Line Type" Case

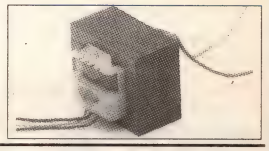
This case is new, but the guts have been removed. Consists of 2 halves held together by four screws.
Size: 88L x 68W x 55Dmm
Cat. HB-6080

1-4	$1.50ea
5-9	$1.35ea
10+	$1.20ea

Cheap 12V Power

1-4	$5.00ea
5-9	$4.25ea
10-25	$3.95ea
25-99	$3.65ea
100+	$3.50ea

240VAC to 2 x 12VAC (at 1 amp) chassis type transformer. See July ads for full details. Normally expect to pay around $16.
Cat. MM-2000



CAR REVERSE LIGHT BULB WITH BEEPER

What a great idea! You simply take out one of your reversing globes and replace it with this. Its the same size as a normal globe, yet incorporates a 20W halogen lamp and a beeper. Allows everybody around you know instantly that you are reversing. You could save a serious accident for $20 and 5 minutes of your time.
Cat. SL-2850 **only$19.95**

Relay Sensation

NEW

We've made a scoop purchase of some top quality Japanese OMRON 240VAC relays. Deals like this don't happen very often. The OMRON No is GZH-Z123T, and its 240VAC DPDT 15 amps. To buy these in small quantities today would cost around $40 each. Dimensions: 55(H) inc spade lugs x 28(W) x 34mm (excluding mounting bracket. **Cat. SY-4080**
October Price $12.50

Parts Cabinets

Interlocking Units.
See cat page 126.
3 Drawer Cat. HB-6323
9 Drawer Cat. HB-6322
Cat Price $6.95ea
Now Only $4.95ea

Save $2ea

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

CHATTERBOX MOTORCYCLE INTERCOM

NEW

Allows uninterrupted two way communication between rider and pillion passenger without turning ones head or lifting visor. Features: •Simple connection •Hands free operation •Fits all kinds of helmets easily •Volume control •Supplied with 2 microphones and 2 earsets •Small size •Amazing low price

Cat. AI-5510 **$39.95**

Ultraviolet EPROM Eraser

Features: •Erase up to 9 chips at a time •Chip drawer has conductive foam pad •Mains powered •High UV intensity at chip surface ensures thorough erase

Cat. XE-4950

$119.95

JAYCAR WHOLESALE

Check us out for amazing prices for quality purchases of:

- •Plug Packs
- •Transformers
- •Plugs & Sockets
- •Wire
- •Speakers
- •Boxes
- •Batteries
- •TV Antennas
- •Solar Panels
- •Alarms
- •Soldering Irons
- •Digital Meters
- •Tools
- •Fans

AND MORE

PHONE: (02) 743 5222 FAX: (02) 743 3070

Ultimate Resistor Pack

10 of every value from 0.5Ω to 9.1Ω in 1/4W 5% mini size. For example 10Ω, 11, 12, 13, 15, 16, 18, 20, 22 etc. Total 170 values. 1700 in total.

Cat. RR-2000

$24.95

New Kit GEIGER COUNTER

NEW

REF: Silicon Chip September 1995

Are you concerned about nuclear testing in the Pacific? Worried about the possible increase in the amount of background radiation? Then check it out with our Geiger Counter Kit. It will detect alpha, beta and gamma radiation and has an audible output. Kit includes PC Board, Case, Geiger Muller Tube, Speaker, Transformer Assembly and all specified components.

Cat. KC-5194 **$179.50**

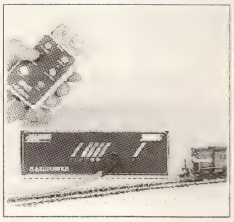
Latest Kits

RAILPOWER MK11

THROTTLE KIT FOR MODEL RAILWAYS

Available early October. REF: Silicon Chip Dept/Oct 95

NEW



This completely new design offers all the features you could want including pulse power, push button control, track voltage metering, inertia (momentum) and full overload protection. Other new features include forward/reverse lockout to prevent the train being thrown into reverse until it first comes to a full stop - complete with adjustable braking time; plus microprocessor control to eliminate what would otherwise be complex circuitry. The Jaycar kit comes with the high quality walkaround control case, PCBs, pre-programmed micro plus all electronic components and basic hardware. Transformer and mounting case not supplied - use MM-2005 and HB-5912.

Cat. KC-5192 **$125.00**

Vader Voice Kit

NEW

REF: Silicon Chip September 1995

This fun project lets you imitate the likes of Darth Vader and other sinister villians from the darker regions of the galaxy. An effects rate and volume control allow you to create varied sounds from the internal speaker, via an external electret microphone (mic housing not included). The Jaycar kit includes case, front panel, PCB, speaker, mic plus electronic componets. 9V battery required (use SB-2370).

Cat. KC-5193 **$27.95**

Jacobs Ladder High Voltage Display Kit

NEW

REF: Silicon Chip September 1995

Ever since scientists Telsla and Edison were able to generate really high voltages the Jacobs Ladder display has been creating awe. Best examples of a Jacobs Ladder can be seen in those early Frankenstein films, and the kit presented here produces a noisy ladder of sparks that look equally as nasty and dangerous - as indeed they are - along with the familiar smell of ozone! Kit includes PCB and electronic components. 12V auto coil required - not incl.

Cat. KC-5191 **$29.95**

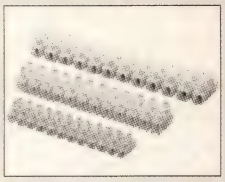
LED Battery Voltage Indicator Kit

REF: ELEC AUST 9/95

This tiny project measures just 25 x 25mm and can be used in just about any piece of battery operated equipment to combine the functions of a power-on LED and battery voltage indicator. Suitable for 6-30 volts. Kit includes PCB and all electronic components including bi-colour LED.

Cat. KA-1778 **$9.95**

Terminal Strip Madness



All strips are 12 way

SMALL Size: 95L x 15W x 15Hmm. Cable entry 2.5mm dia

Cat. HM-3196 Cat Price $1.25

Oct 80¢ ea or 10 for $6

MEDIUM Size: 115L x 19W x 17Hmm. Cable entry 3.0mm dia

Cat. HM-3200

Cat Price $1.50

Oct $1 ea or 10 for $8

LARGE Size: 136L x 22W x 19Hmm. Cable entry 4.5mm dia

Cat. HM-3198

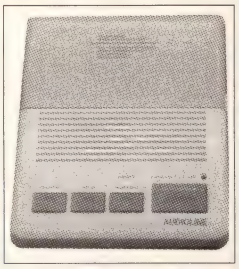
Cat Price $1.95

Oct $1.25 ea or 10 for $10

AUDIOLINE ANSWERING MACHINE

SAVE $10 ON CATALOGUE PRICE

Features •full logic micro cassette deck •micro-processor control •optional remote control •remote turn on •memo recording facility •call screening •message received indicator/counter •variable length outgoing message •rewind, playback and fast forward •volume control. Complete with a twelve month replacement guarantee.



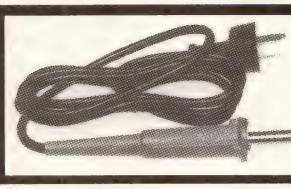
Cat. YT-7041 WAS $89 **NOW $79**

860 MODEL WITH DAY AND DATE STAMPING Cat. YT-7042 **$109**

JAYCAR SOLDERING IRON

Cat. TS-1450

ONLY $17.95



FREE 200G ROLL 1MM SOLDER WITH EVERY PURCHASE IN OCTOBER. VALUE $6.75 CAT. NS-3010

Poker / Blackjack Game

Now you can take out your gambling frustrations without fear of losing your money, and have hours of fun. It sits in the palm of your hand, colour backed LCD display, soft touch keys, music or music mute, robust construction - so it can take the aggrevation of losing. Runs on 2xAA batteries (not supplied).POKER: Just like the real poker card machines in Clubs, Pubs etc. •Can bet high or low •Double up as many times as you like •Bet from $1 to $100 per bet BLACKJACK - JUST LIKE THE REAL CASINO'S: •Can split •Can have insurance like the dealer •If you have never played Blackjack this game will teach you how to play. For example - "word" prompts appear when other options are available (Split, Double your bet and insurance to the gambler).• Bet from $1 to $100 per bet.

Cat. QM-7360 **$17.95**

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

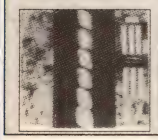
Playmaster 300W Amplifier Kit — Bargain

We have sold 000's of these over the years. See 1995 catalogue page 9. Delivers 300WRMS into 4Ω and 200WRMS into 8Ω.

AMP MODULE Cat. KA-1115 **$89.95**

POWER SUPPLY INC X'FORMER Cat. KA-1116 **$115.00**

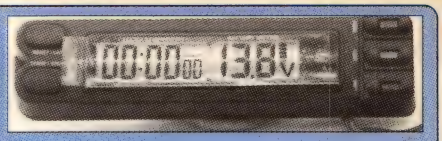
SPEAKER PROTECTOR Cat. KA-1117 **$19.95**



TOTAL **$224.90**

OCTOBER - BUY THE LOT FOR ONLY $189 SAVE $36

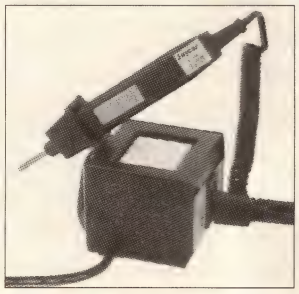
CAR VOLTAGE METER / CLOCK / STOPWATCH



Features: •Automatic 12/24V selection •Digital readout for battery voltage •Lap counting •Stopwatch for sports •Digital clock 12/24 hour selectable •Backlit •Small size 115(W) x 27(H) x 15(D)mm

Cat. XC-0118 **Only $29.95**

LOW COST TEMPERATURE CONTROLLED SOLDERING IRON



Ideal hobbyist soldering station. It operates on 240 volts, and the transformer delivers a safe 16 volts to the soldering iron.
It has a PTC (Positive Temperature Coefficient) soldering tip at a constant temperature of 310°C which is ideal for PCB work.

Cat. TS-1200 **1994 price $49.95 NOW $29.95**

Free PC Interface With Purchase of 128K Databank With 6 Language Translator

Features: •telephone databank •business card library •real time clock •calendar •calculator •currency •memo •schedule •world time •6 language translator - English, French, German, Italian, Spanish and Dutch •5,940 useful phrases are classified into 13 categories - greetings, air travel/customs, hotel, resaurant, sight seeing, shopping, communications, medical /emergency, financial, transportation/directions, entertainment, sports /leisure, beauty/hygiene. Total words approx 42,000 (inc sentences).

Cat. QM-7330 **$179.00**

PLUS FREE PC INTERFACE - VALUE $39.50

THE BIGGEST SUBWOOFER

If you want the Biggest Subwoofer, then the Re/sponse is it. Unbeleivable Power and Bass!!! See the review of it in Electronics Australia January 1993. The cabinet stands over 1 metre tall by 390mm wide and 440mm deep and its black. The driver is the 12" Re/sponse 8Ω carbon fibre cone unit. It will handle 200WRMS no problems to deliver window rattling (in next doors house) bass.

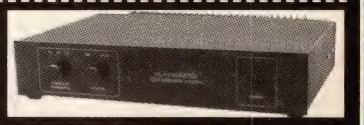
RE/SPONSE WOOFER Cat. CW-2145 **$209.00**

SUBWOOFER CABINET Cat. CS-2485 **$195.00**

TOTAL **$404.00**

DEAL ONE: BUY BOTH TOGETHER IN OCTOBER FOR $369 SAVE $35

NEED AN AMPLIFIER TO DRIVE IT?



You can't go past our Playmaster 300W Subwoofer Amplifier Kit with Active Crossover Included. See Elec Australia April 1995 or Jaycar 1995 catalogue page 4 for details.

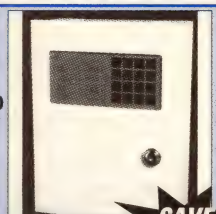
DEAL TWO: DRIVER & CABINET PLUS THE PLAYMASTER SUBWOOFER / CROSSOVER KIT

SUBWOOFER	$209.00
CABINET	$195.00
SUBWOOFER AMPLIFIER	$349.00
TOTAL	$753.00

TOTAL SAVING $54

PAY ONLY $699

Bellmate 950 Alarm Deal



The Bellmate 950 is a 4 Sector Home Burglar Alarm Control Panel. See 1995 catalogue P72/73 for full details.

FOR OCTOBER - BUY THE 950 ALARM PANEL AND RECEIVE THE 960 REMOTE KEYPAD ABSOLUTELY FREE.

BELLMATE 950 Cat. LA-5324 **$149.00**

BELLMATE 960 Cat. LA-5321 **$49.95**

$198.95 Total

SAVE $$$

OCTOBER - ONLY $149 FOR BOTH

WIRELESS DOORBELL

This doorbell requires no wiring from the push button to the receiver. The push button is white in colour and has a LED to confirm transmission. Size: 63(H) x 39(W) mm. The receiver has a high or low volume switch and gives a pleasant "ding dong" sound.

TRANSMITTER & RECEIVER Cat. AI-5520 **$24.95**

EXTRA RECEIVER Cat. AI-5525 **$19.95**

Jaytech 8 X AA Fast Charger

If you use a lot of AA Nicads and need them fast charged, then this is the unit. It caters for the new type 700mAh batteries. Fast charges them, then automatically switches over to trickle charge. Features Include:
•Recharges 2, 4, 6 and 8 pcs of AA or AAA at a time •Selector switch to alter charging time for 500mAh, 600mAh & 700mAh batteries •LEDs indicate proper charging •Auto current adjustments for AA or AAA batteries •Advanced charging circuit with protection when a charging group is placed with different batteries (AA or AAA) •Charging times - AA 500mAh - 120 mins, AA 600mAh & AAA 180mAh - 144 mins, AA 700mAh & AAA 220mAh - 168 mins •Fast charge for specified period then automatically switches to trickle charge •Electricity authority approved.

Cat MB-3510 **$39.95**

Jaytech Universal Fast NiCad Battery Charger With Discharger

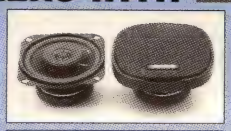
This has got to be the "It does everything charger". It will automatically discharge the cell, then fast charge them, then switch to trickle charge. No more trying to remember to switch off the charger. The auto discharger eliminates the dreaded "memory effect" which plagues Nicads. Features: •Recharges 1 to 4 pcs AA, AAA, C and D Nicads in 4 hours •Auto selects the correct charge/discharge rate for different batteries •Combined with discharge function - batteries are fully discharged before fast charging resulting in full charging capacity of batteries and no "memory effect" •When all batteries have been discharged, it automatically switches to charging them •Charger automatically switches from fast charge to trickle charge to prevent damage from overcharging •LED indicators show if charger is discharging, fast charging or trickle charging •9 volt batteries are not fast charged or discharged •240V mains powered •Electricity authority approved.

Cat MB-3500 **$59.95**

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

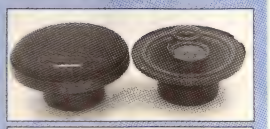
YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

CAR SPEAKERS WITH 2 YEAR WARRANTY!!!



4" 2 Way
Cat. CS-2250
$37.95pr

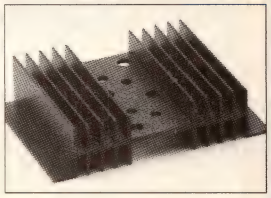
6" 3 Way Rear
Cat. CS-2262
$59.95pr
See 1995 catalogue for full details - page 61.



6" 3 Way Door
Cat. CS-2258
$48.95pr

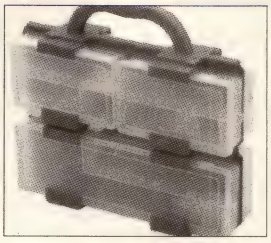
6" x 9" 3 Way
Cat. CS-2268
$109pr

1/2 PRICE DRILLED HEATSINK



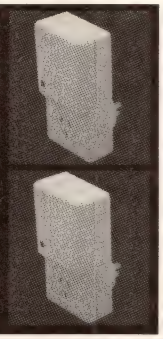
Drilled for 2 x T03. Size 102W x 72L x 23Hmm
CAT PRICE $6.50
October $3.25
HALF PRICE Cat. HH-8561

COMPONENT CARRY CASE



Includes carry case skeleton and 6 plastic cases. See our 1995 catalogue P124 for full details.
CAT PRICE $19.95
Oct $14.95
SAVE $5 Cat. HB-6345

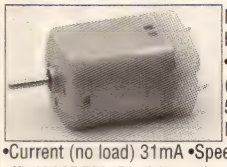
NEW MAINS FILTERS



Power Surge Protector
Protection by Metal Oxide Protectors. Similar unit was selling for $31. **Cat. MS-4010**
Only $19.95

Power Surge Line Filter
Will filter EMI and RFI. Protection by Toroidal Coil and MOV's **Cat. MS-4008**
Only $49.95

12 VOLT HOBBY MOTOR SALE



Mabuchi brand. •Speed (no load) 5625 RPM •Current (no load) 31mA •Speed (max eff) 4200RPM •Dia 24mm •Length 35mm •Shaft Length 10cm •Dia 2mm. See 1995 catalog P188 for full details.
CAT PRICE $3.95
Oct $2.50
SAVE $1.45 Cat. YM-2710

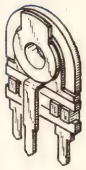
GIFT VOUCHERS NOW AVAILABLE

Gift vouchers are an ideal way to give a gift to someone. Simply purchase on for any amount you nominate, and the receiver can bring it to any Jaycar store to collect whatever he/she wishes to the value.

Fibreglass Double Sided PCB Bargain

We have a limited quantity of these PCBs available. Size: 355 x 167mm. Normally these would cost around $10.
Cat. HP-9516 ONLY $5

10mm Trim Pot Madness

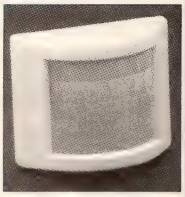


We are overstocked. These normally sell for 60¢ eac. Now only $2 for 10 of the same value.
STOCK UP NOW

Cat. No	Type
RT-4030	100 ohm
RT-4031	200 ohm
RT-4033	500 ohm
RT-4034	1k
RT-4035	2k
RT-4037	5k
RT-4039	10k
RT-4040	20k
RT-4042	50k
RT-4043	100k
RT-4044	200k
RT-4046	500k
RT-4047	1M
RT-4048	2M

$2 for 10 Of The Same Value

Jaytech Advanced Pulse Count PIR



AMAZING QUALITY FOR UNDER $30. Features Advanced Pulse Count - the latest in PIR's which virtually eleminates false alarms. •small size •SMT •supplied with bracket •shielded relay •lenses available
Only $29.95
Cat. LA-5025

Wide angle lens	**Cat LA-5026**	**$3.95**
Curtain / pet lens	**Cat LA-5027**	**$3.95**
Hall / long range	**Cat LA-5028**	**$3.95**

NEW KIT Induction Loop TV Headphones Kit

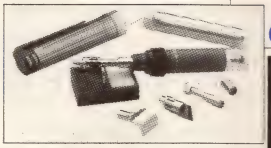
HEADPHONES NOT SUPPLIED

REF: ELECTRONICS AUSTRALIA OCT 1995
An induction loop is a loop of wire mounted around a room, then connected to a TV set (or CD player) speaker. The TV drives the loop as though it were a speaker, and thus a fluctuating magnetic field with the same characteristics as the original audio signal is produced within the room. This kit is the pick-up unit into which mono headphones are connected. A great idea for those who may suffer from poor hearing. Case, PCB, ferrite and electronic components included. Use WB-1620 4 core cable for loop. 9V battery required use SB-2370.
$19.95 Cat. KA-1779

THE LATEST KITS

Cat	Description	Price
KA-1778	Car low battery volt indicator	9.95
KA-1776	Parallel breakout box	45.00
KA-1775	Flexitimer Mk2	22.95
KA-1774	PC driven ECG	34.95
KA-1773	Economy surround sound	69.50
KC-5193	Vader voice Mk2	27.95
KC-5192	Railpower Mk2 train	125.00
KC-5191	Jacobs Ladder	29.95
KC-5190	Gain control mic preamp	29.95
KC-5189	Fuel injector monitor	49.95
KC-5188	Door minder	27.95
KC-5187	Electric fence	29.95
KC-5186	Train detector	13.95
KC-5185	Guitar headphone amp	29.95

HOT SOL SERVICE KIT



Don't buy tools you don't need with the Soldering Iron set! Includes: •1 x Hot-Sol Butane Gas Tool •1 x Protective Cap •1 x Non-slip stand with sponge •1 x Torch Tip which gives a flame •1 x 2.4mm Soldering Tip •1 x Hot Knife Tip •1 x Roll Solder •1 x Case which holds everything •1 x Hot Blow Tip for shrinking heatshrink tubing •1 x Scoop for feeding tubing to hot blow tip
Cat. TS-1702 only $49.95

BUY 10 LESS 10%

SAVE $$ ON Jaycar RE/SPONSE

4Ω CAR SUB WOOFERS FOR OCTOBER

See our 1995 catalogue, or call for full details. These speakers will give excellent results at amazing low prices. All drivers are 4 ohm impedance and have rubber surrounds & huge magnets.

CS-2234

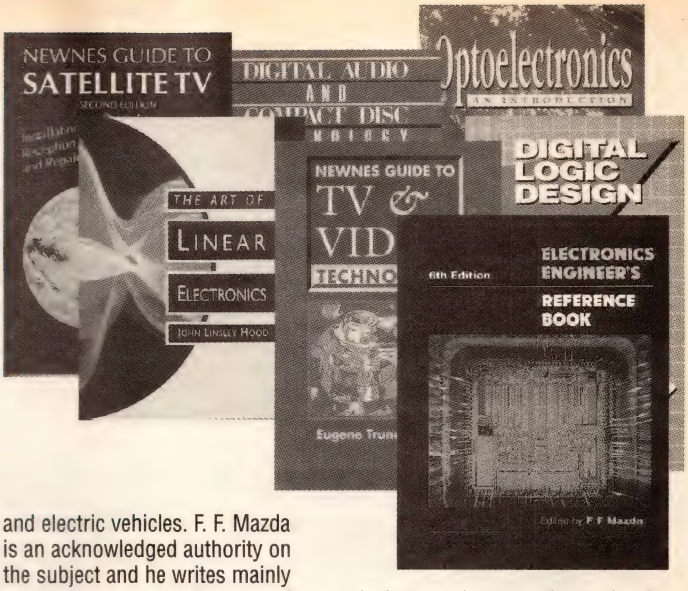
CS-2238

Size Inch	Cone Material	Power Handling	Box Size Vented	Box Size Sealed	Cat No.	Cat Price	October Price	Save $$$$
6"	Polycone	80WRMS	13LT	7.7LT	CS-2232	$49.50	$39.50	$10.00
8"	Polycone	120WRMS	25LT	20LT	CS-2234	$65.00	$52.00	$13.00
10"	Polycone	160WRMS	50LT	30LT	CS-2236	$99.50	$84.50	$15.00
12"	Polycone	200WRMS	105LT	67LT	CS-2238	$135.00	$115.00	$20.00

YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

SILICON CHIP BOOK SHOP



Newnes Guide to Satellite TV

Installation, Reception & Repair. By Derek J. Stephenson. First published 1991, reprinted 1994 (3rd edition).

This is a practical guide on the installation and servicing of satellite television equipment. The coverage of the subject is extensive, without excessive theory or mathematics. 371 pages, in hard cover at $55.95.

Servicing Personal Computers

By Michael Tooley. First published 1985. 4th edition 1994.

Computers are prone to failure from a number of common causes & some that are not so common. This book sets out the principles & practice of computer servicing (including disc drives, printers & monitors), describes some of the latest software diagnostic routines & includes program listings. 387 pages in hard cover at $59.95.

The Art of Linear Electronics

By John Linsley Hood. Published 1993.

This is a practical handbook from one of the world's most prolific audio designers, with many of his designs having been published in English technical magazines over the years. A great many practical circuits are featured – a must for anyone interested in audio design. 336 pages, in paperback at $49.95.

Optoelectronics: An Introduction

By J. C. A. Chaimowicz. First published 1989, reprinted 1992.

This particular field is about to explode and it is most important for engineers and technicians to bring themselves up to date. The subject is comprehensively covered, starting with optics and then moving into all aspects of fibre optic communications. 361 pages, in paperback at $55.95.

Digital Audio & Compact Disc Technology

Produced by the Sony Service Centre (Europe). 2nd edition, published 1992.

Prepared by Sony's technical staff, this is the best book on compact disc technology that we have ever come across. It covers digital audio in depth, including PCM adapters, the Video8 PCM format and R-DAT. If you want to understand digital audio, you need this reference book. 247 pages, in paperback at $59.95.

Power Electronics Handbook

Components, Circuits & Applications, by F. F. Mazda. Published 1990.

Previously a neglected field, power electronics has come into its own, particularly in the areas of traction and electric vehicles. F. F. Mazda is an acknowledged authority on the subject and he writes mainly on the many uses of thyristors & Triacs in single and three phase circuits. 417 pages, in soft cover at $59.95.

Digital Logic Design

By Brian Holdsworth. First published 1982. 3rd edition 1993.

This well-established book covers topics from digital logic principles & design through to programmable logic arrays, fault diagnosis & testing & coding systems for error control. 596 pages, in paperback at $52.00.

Electronics Engineer's Reference Book

Edited by F. F. Mazda. First published 1989. 6th edition 1994.

This just has to be the best reference book available for electronics engineers. Provides expert coverage of all aspects of electronics in five parts: techniques, physical phenomena, material & components, electronic design, and applications. The sixth edition has been expanded to include chapters on surface mount technology, hardware & software design, semicustom electronics & data communications. 63 chapters, in paperback at $140.00.

Radio Frequency Transistors

Principles & Practical Applications. By Norm Dye & Helge Granberg. Published 1993.

This timely book strips away the mysteries of RF circuit design. Written by two Motorola engineers, it looks at RF transistor fundamentals before moving on to specific design examples; eg, amplifiers, oscillators and pulsed power systems. Also included are chapters on filtering techniques, impedance matching & CAD. 235 pages, in hard cover at $85.00.

Newnes Guide to TV & Video Technology

By Eugene Trundle. First published 1988, reprinted 1990, 1992.

Eugene Trundle has written for many years in *Television* magazine and his latest book is right up date on TV and video technology. 432 pages, in paperback, at $39.95.

Your Name_____
PLEASE PRINT

Address_____

_____ Postcode_____

Daytime Phone No._____ Total Price $A _____

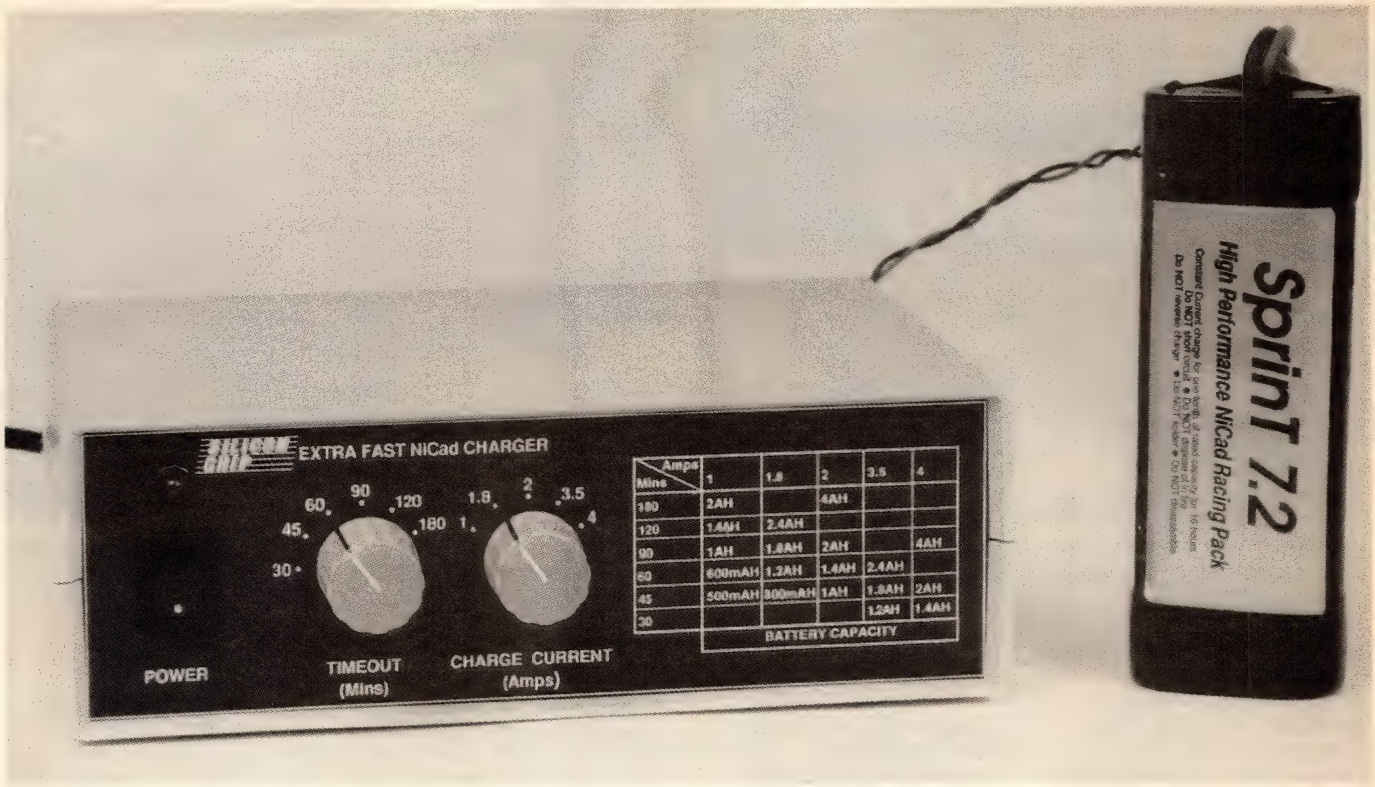
❑ Cheque/Money Order ❑ Bankcard ❑ Visa Card ❑ MasterCard

Card No. | | | | | | | | | | | | | | | |

Signature_____ Card expiry date____/____

Return to: Silicon Chip Publications, PO Box 139, Collaroy NSW, Australia 2097. Or call (02) 9979 5644 & quote your credit card details; or fax to (02) 9979 6503.

✔	Title	Price
❑	Newnes Guide to Satellite TV	$55.95
❑	Servicing Personal Computers	$59.95
❑	The Art Of Linear Electronics	$49.95
❑	Optoelectronics: An Introduction	$55.95
❑	Digital Audio & Compact Disc Technology	$59.95
❑	Power Electronics Handbook	$59.95
❑	Digital Logic Design	$52.00
❑	Electronic Engineer's Reference Book	$140.00
❑	Radio Frequency Transistors	$85.00
❑	Newnes Guide to TV & Video Technology	$39.95
	Postage: add $5.00 per book. Orders over $100 are post free within Australia. NZ & PNG add $10.00 per book; elsewhere add $15 per book.	
	TOTAL $A	



A fast charger for nicad batteries

This nicad charger lets you fast charge nicad battery packs from a 12V car battery. It can charge packs of 5 to 10 cells at once and automatically reverts to trickle mode at the end of the charging cycle.

By JOHN CLARKE

Nicad battery packs seem to have a habit of going flat just when you want to use them, particularly when there is no readily available source of mains power to operate a recharger. Of course you can always call upon a spare battery but what happens when it also goes flat after some use?

This Extra Fast Nicad Charger is the answer to your nicad battery problems. It operates from a car battery so you don't need mains power and it can recharge a nicad battery pack in far less time than it takes using a conventional charger.

At the maximum charge current of 4A, you can charge a 1.4Ah battery in less than 30 minutes. For higher capacity batteries, the charge time will be longer but most batteries with less than a 2Ah capacity can be charged in under 45 minutes.

Sensing techniques

With high charge rates, nicad batteries can be damaged if they are not charged correctly. As a result, the Extra Fast Nicad Charger employs four sensing methods to ensure that charging ceases before any damage is done to the cells. These are as follows:

(1). Over-temperature sensing: If nicad cells are overcharged, they become hot and this causes cell damage. To prevent this from happening, the circuit monitors the temperature of the battery pack using a thermistor and switches the circuit to the trickle charge mode if the temperature rises above a preset level (45°C).

(2). Low voltage sensing: Nicad cells that have been discharged to a very low voltage can be damaged if initially fast charged. The circuit prevents this by monitoring the battery voltage and initially trickle charging the battery until it reaches a preset value. It then automatically switches over to fast charging.

(3). Voltage sensing: When a nicad

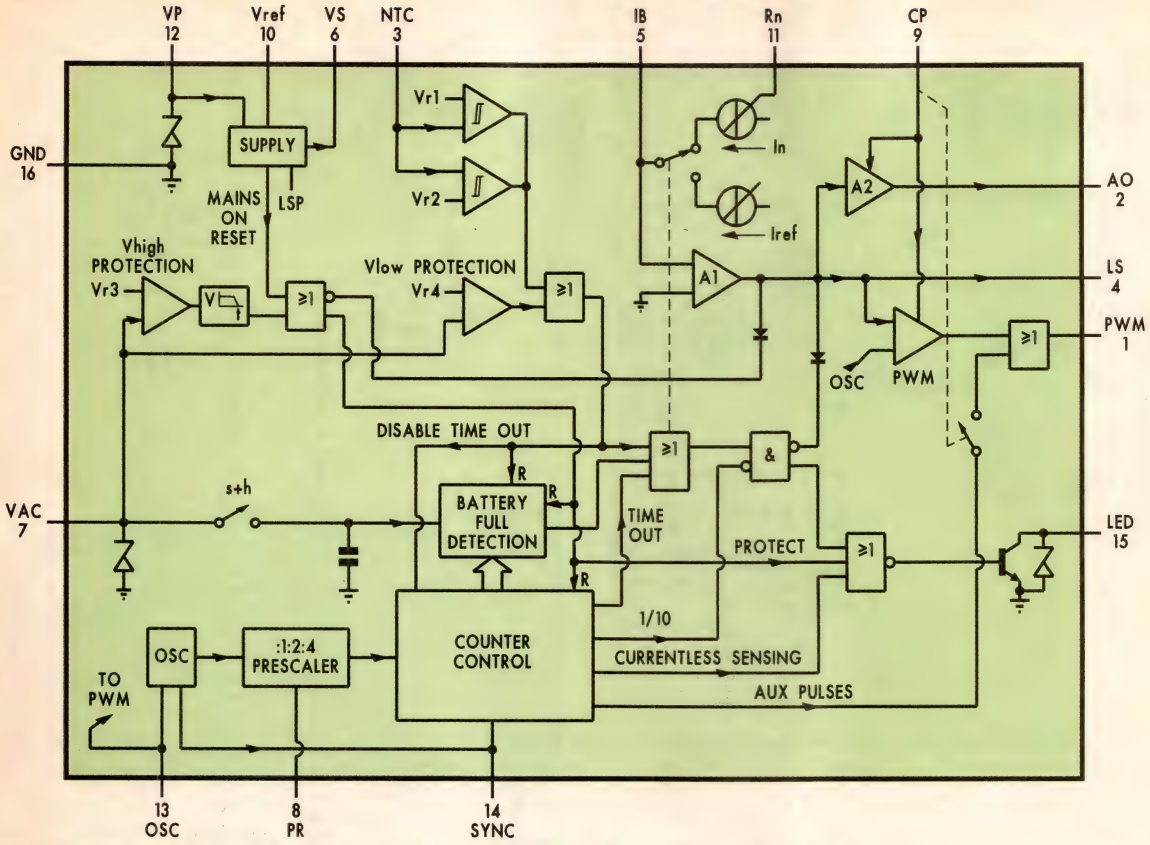


Fig.1: block diagram of the TEA1100 which is designed specifically for nicad battery charging. It includes automatic timeout and -dV detection circuitry and features both linear and PWM outputs.

battery pack is fully charged, further charging causes its output voltage to fall slightly. This slight voltage drop is sensed using a method known as -dV detection, at which point the circuit is switched to the trickle charge rate.

(4). Automatic timeout: As a final precaution, the circuit employs a timer which can be set to one of six intervals ranging from 30-180 minutes. If, for some reason, the battery voltage does not drop within a certain time, this timer automatically switches the circuit to trickle charge mode.

Note that -dV detection can be unreliable if it takes longer than one hour to fully recharge a battery. This is because the output voltage drops very slowly after full charge at the lower charging currents and may not be detected.

The timer is a "belts-'n-braces" feature – it's there as a backup if the -dV sensing circuit fails to detect full charge.

Indicators & controls

As shown in the photos, the Extra Fast Nicad Charger is housed in a compact plastic case. There are just three switches on the front panel: (1) an on/off switch; (2) a 6-position rotary switch to set the timer (30-180 minutes); and (3) a 5-position rotary switch to set the charging current (1-4A).

A table on the front panel shows the required switch settings for the various battery capacities available. These settings must be used in order to prevent battery damage.

Also on the front panel is a LED indicator which shows the charging mode. When the LED is continuously lit, the charger is fast charging. When the LED flashes, the charger is in trickle charge mode.

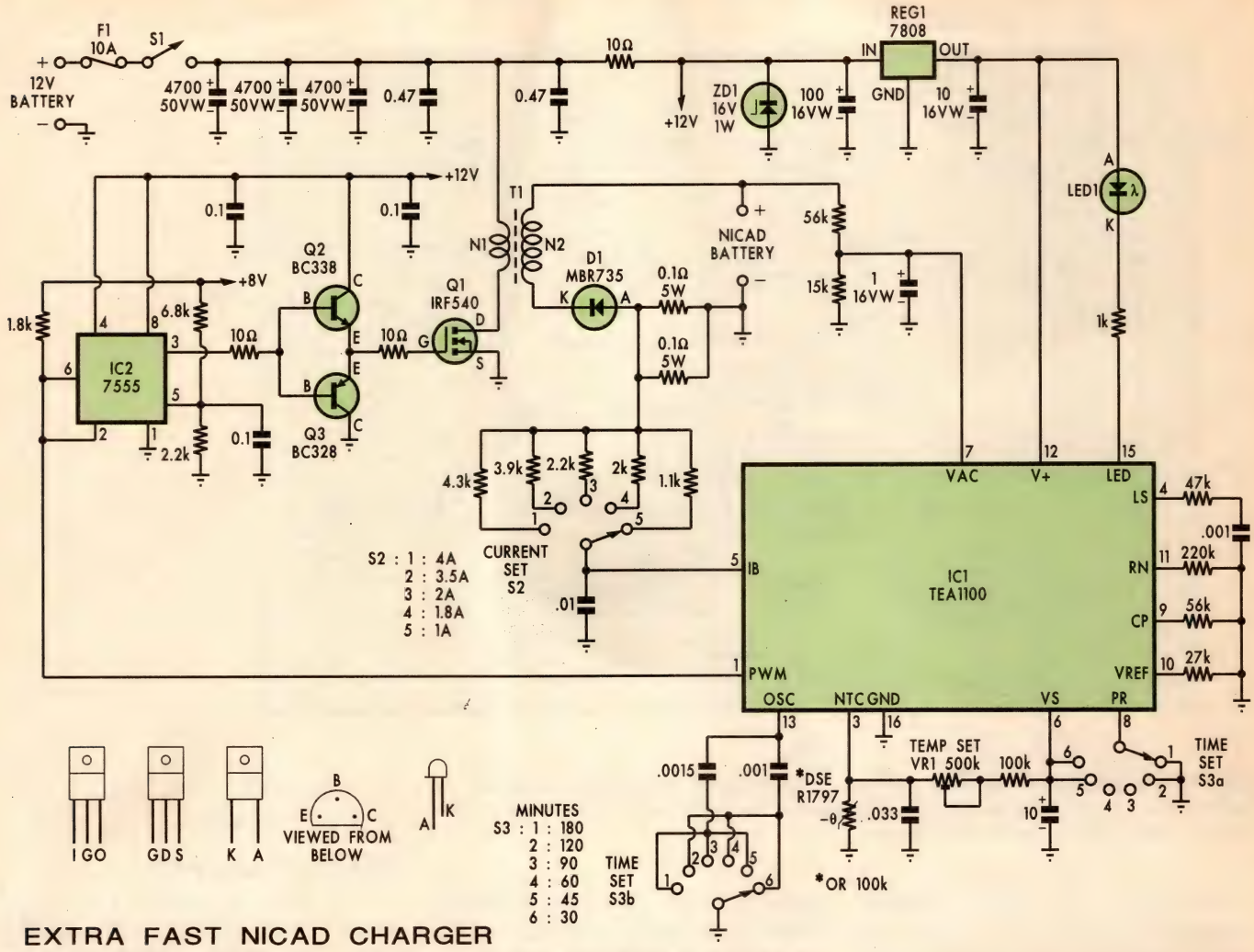
Battery charger IC

The circuit is based on a Philips TEA1100 charger IC which is specifically designed for nicad cells. Its schematic is shown in Fig.1.

Most of the IC circuitry is controlled by a single oscillator which is used for timeout counting, driving a pulse width modulator (PWM) for switch mode operation, and for various timing processes. These timing processes include a periodic "quiet time", during which battery charging ceases so that its voltage can be measured without switchmode noise. In the trickle charge mode, the PWM output is applied in short bursts for

Main Features

- Fast charging
- Powered from a car battery
- Charging stopped using three detection methods: by monitoring battery temperature, drop in battery voltage at full charge and charging time
- Five charging currents from 1-4A
- Suits most battery packs with 5-10 cells
- Charging indicator LED
- Trickle charging after fast charge
- Fuse protection for reverse polarity and shorts
- Short-circuit proof



EXTRA FAST NICAD CHARGER

Fig.2: the circuit of the charger. IC2, Q2 & Q3 together drive Mosfet Q3 and this switches transformer T1 to form a boost converter. This steps up the 12V input voltage to a level sufficient to charge as many as 10 nicads in a battery pack; ie, a maximum of about 18V. The boost converter is under the control of IC1, the TEA1100 battery monitor.

about one period on to 10 periods off.

Apart from the oscillator, the IC circuitry is also controlled by a resistor which is connected between Vref (pin 10) and ground. This resistor sets up a current reference (Iref) for the circuit. The actual charge current is then set by this reference current and the value of an external current set resistor.

In operation, the IB pin monitors the voltage across an external dropping resistor which carries the nicad charge current. This voltage is then fed to internal op amp A1.

Any error will be amplified by A1 and compared with the oscillator waveform in a PWM comparator. The result is a pulse train at pin 1 with a duty cycle varying according to the error signal at the A1 output.

The CP input, pin 9, controls the output polarity at pin 1. In addition, an analog output appears at pin 2 and is used to control circuits employing linear regulation. This latter output is not used in this design, which employs PWM control only.

During trickle charge, a resistor at Rn (pin 11) controls the current into the battery. The current is also determined by the state of the PR pin (pin 8) which controls a prescaler to divide the oscillator signal by 1, 2 or 4.

Pin 7, the VAC input, monitors the voltage of the battery being charged. For normal (ie, fast) operation, this voltage must be between 0.385V and 3.85V and is set using a voltage divider network to suit the batteries that are to be charged.

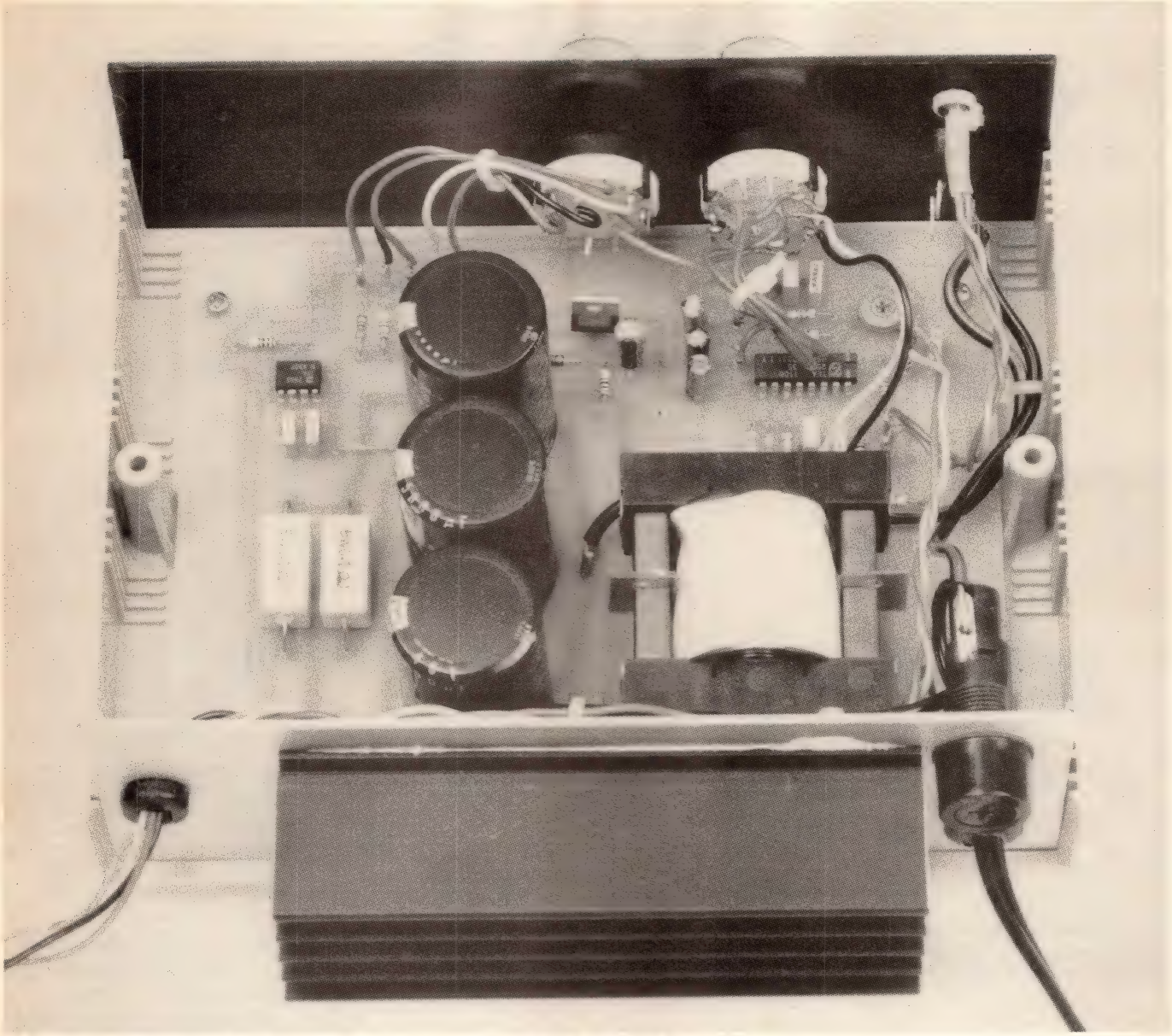
A voltage on pin 7 that's outside this range initiates the trickle charge mode. In addition, the battery full detection circuitry initiates the trickle charge mode when it detects a 1% fall in battery voltage.

The NTC input at pin 3 is used to monitor the voltage across a thermistor. This is the temperature sensing circuit. As shown, it drives a couple of internal Schmitt trigger comparators. When the temperature of the battery pack exceeds a certain value (ie, when the voltage at pin 3 drops below a critical level), one of the Schmitt triggers toggles and the current is reduced to trickle mode (the other Schmitt trigger is used for under-temperature sensing but this is not a problem in Australia).

Finally, the LED output at pin 15 goes low when the IC is in fast charge mode. Alternatively, this pin switches between high and low (to flash the LED) when the IC reverts to the trickle charge mode.

Circuit details

Refer now to Fig.2 for the full circuit details. Apart from the TEA1100



This inside photo shows the general arrangement of the PC board in the case. Note how mica washers have been used to set the gap between the transformer cores (see text).

IC, it employs a 7555 timer (IC2) two transistors, an N-channel Mosfet and a 3-terminal regulator (REG1).

The resistors at pins 10 & 11 of IC1 set the reference currents for the fast and trickle charge rates, as described previously. The oscillator control input is at pin 13 and this pin is connected to ground via one of two capacitors, as selected by S3b. When the .0015µF capacitor is selected, the oscillator runs at 25kHz. Conversely, when the .001µF capacitor is selected, the frequency increases to 37kHz.

S3a selects the prescaler value. In positions 1 & 2, pin 8 is grounded and the prescaler divides the oscillator frequency by 4. Similarly, positions 3 & 4 set the prescaler to divide by 2 (pin 8 open circuit), while positions 5 & 6 set the prescaler to divide by 1 (pin 8 connected to the 4.2V bias voltage Vs at pin 6).

Combined with switch S3b, S3a sets the timeout period to one of six values: 30, 45, 60, 90, 120 & 180 minutes.

The NTC input (pin 3) is connected to a thermistor and also to the 4.2V bias voltage via VR1 and a 100kΩ resistor. Normally, the thermistor resistance is about 100kΩ at 25°C. However, as the temperature rises, the thermistor resistance falls and this reduces the voltage at the NTC input.

If the voltage at the NTC input falls below 0.8V, the IC immediately switches to trickle mode and remains there until the voltage increases to about 0.9V. VR1 allows the temperature trip point to be adjusted, while the adjacent .033µF capacitor prevents false triggering by bypassing any high frequency signals from the switchmode supply.

The PWM output at pin 1 of IC1 is designed to drive a step-up converter and this is based here on Mosfet Q1, transformer T1 and Schottky diode D1. In practice, however, the PWM waveform at pin 1 is not suitable for directly driving the Mosfet. This is because the voltage does not swing sufficiently high to fully turn on the device, nor is the output current sufficient to charge the gate capacitance of the Mosfet in the time allowed.

To overcome this problem, 7555

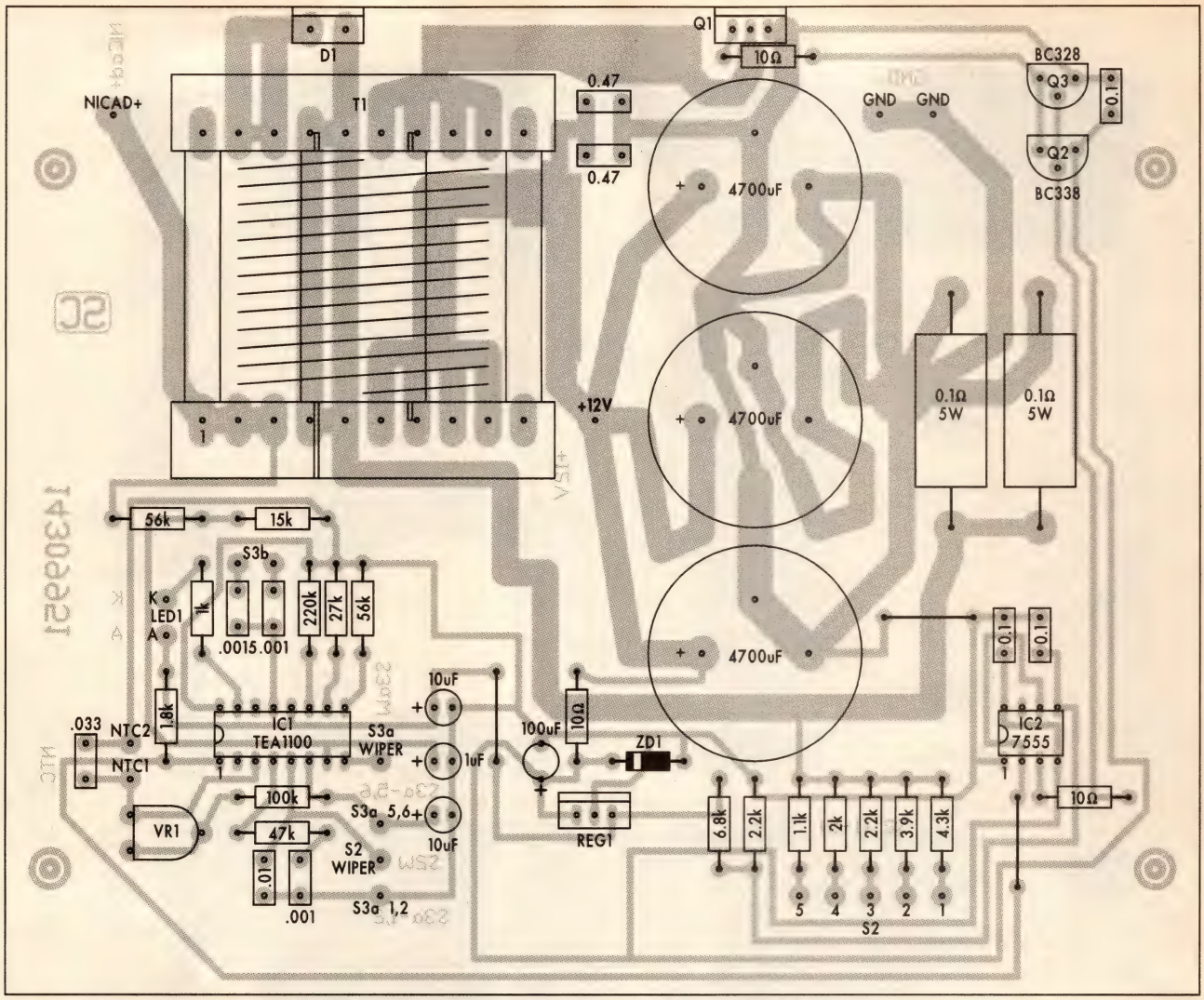


Fig.3: install the parts on the PC board as shown in this wiring diagram, taking care to ensure that all polarised parts are correctly oriented. Note that Q2 is a BC338 transistor while Q3 is a BC328 type, so don't get them mixed up.

timer IC2 is used as a buffer stage. This is a rather unusual application for a 7555 timer IC, since it does not function as a timer at all. Instead, it is used to convert the 0-7V PWM signal to a 0-12V signal at its pin 3 output.

As shown on Fig.2, the upper threshold of the 7555 is set to about 2V by the 6.8kΩ and 2.2kΩ resistors at pin 5. This, in turn, sets the pin 2 threshold to 1V. As a result, when pins 6 & 2 are taken above 2V, pin 3 goes low. Conversely, when the input goes below about 1V, pin 3 goes high.

Because IC2 is powered from +12V, it effectively converts the PWM output from IC1 into a 0-12V signal. It also inverts the signal and so to maintain the correct output phase, the PWM output from IC1 is inverted by connecting a 56kΩ resistor to the CP input at pin 9.

The output from IC2 drives complementary pair Q2 & Q3 which in turn provide the current pulses to drive the gate of Q1.

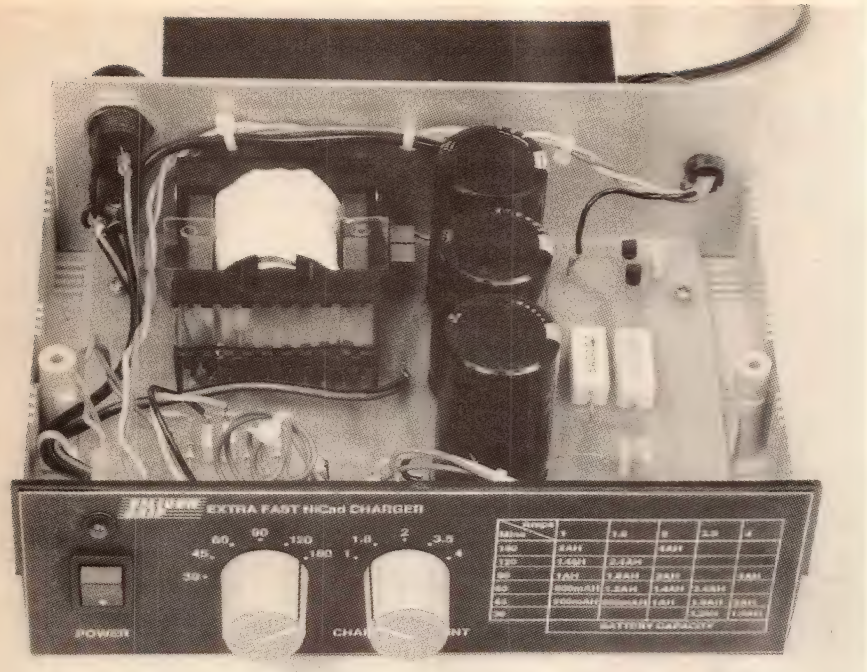
Q1 is used to switch the N1 winding of transformer T1. This transformer has a turns ratio (N1:N2) of 1:1.7, to provide sufficient voltage step-up for recharging battery packs above 12V. Diode D1, an MBR735 fast recovery type, rectifies the transformer output so that the battery is charged with the correct polarity.

The charge current through the batteries is sensed by the two 0.1Ω 5W resistors and the voltage developed across them is fed via one of five resistors, as selected by S2, to op amp A1 inside IC1 (at pin 5). This op amp compares the voltage developed across the current sensing resistors and produces an error signal to control the PWM oscillator. This, in turn, adjusts the PWM output signal at pin 1 so that the charging current is correct.

The .01µF capacitor at pin 5 filters out any transient voltages which could otherwise cause false current settings. In addition, the output of error amplifier A1 is filtered using a 47kΩ resistor and a .001µF capacitor at pin 4.

As the battery charges, its voltage is monitored via a voltage divider network (56kΩ & 15kΩ). The resulting voltage sample is filtered using a 1µF capacitor and applied to pin 7 (VAC) of IC1. When the battery is fully charged, the IC detects the slight drop in battery voltage and automatically switches to the trickle mode as described above.

Power for the circuit is fed from a 12V car battery via fuse F1. This fuse protects against shorts and reverse polarity connections. If the 12V battery is wrongly connected, an internal reverse diode in Q1 will conduct and blow the fuse.



The PC board is secured to integral standoffs in the base of the case using four self-tapping screws. Note the use of plastic cable ties to beep the internal wiring neat and tidy.

The 12V rail is decoupled using three 4700µF capacitors and two 0.47µF capacitors. These provide the high current pulses required by T1. A 10Ω resistor and 16V zener diode ZD1 protect IC2 from high voltage transients on the 12V rail, while 3-terminal regulator REG1 supplies 8V to IC1. In addition, the output of REG1 supplies power to LED 1, the other side of which is connected to pin 15 of IC1 via a 1kΩ current limiting resistor.

Construction

Most of the parts for the Extra Fast Nicad Charger are mounted on a PC board coded 14309951 and measuring 171 x 140mm. Fig.3 shows the parts layout.

Begin by carefully checking the PC board against the published pattern. In particular, check for broken or shorted tracks.

When you are satisfied that the board is OK, begin the assembly by installing PC stakes at all the external wiring points (19 in all). This done, install the wire links, followed by the ICs and the resistors. Table 1 shows the resistor colour codes but it is always a good idea to check them using a digital multimeter, as some colours can be difficult to read.

The zener diode, 3-terminal regulator and transistors Q2 & Q3 can now be installed. Make sure that these parts are all correctly oriented and don't get the two transistors mixed up. REG1 must be installed with its metal tab towards ZD1.

Diode D1 and transistor Q1 are installed with their metal tabs towards the edge of the board. Install them with their mounting holes about 22mm above the board, so that they can later be bolted to the rear panel.

Next, install the capacitors on the board, starting with the smaller devices and finishing with the three 4700µF electrolytics. The temperature sensing feature may not be needed for some applications. If you don't wish to use it, connect a 100kΩ resistor across the NTC1 and NTC2 terminals.

Winding the transformer

Transformer T1 is wound using 0.8mm-diameter enamelled copper wire – see Fig.4.

Begin by cutting four 550mm lengths of wire and soldering these to pins 9, 8, 7 and 6 of the transformer bobbin. This done, wind these four wires together (ie, side-by-side) onto the bobbin in the direction indicated until you have completed 24 turns. Terminate the free ends to pins 12, 13, 14 & 15 respectively (ie, 9 to 12, 8 to 13, etc), then insulate the winding with a single layer of paper held with insulating tape.

Next, cut two 940mm lengths of wire and connect these to pins 2 & 3. These two wires are then wound on together for 41 turns in the same direction as the previous winding – see Fig.4. Terminate their free ends on pins 19 & 18 (ie, 2 to 19; 3 to 18) and

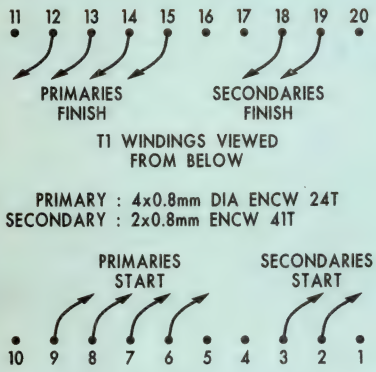

11 12 13 14 15 16 17 18 19 20
PRIMARIES FINISH
SECONDARIES FINISH
T1 WINDINGS VIEWED FROM BELOW
PRIMARY : 4x0.8mm DIA ENCW 24T
SECONDARY : 2x0.8mm ENCW 41T
PRIMARIES START
SECONDARIES START
10 9 8 7 6 5 4 3 2 1

Fig.4: this diagram shows the winding details for transformer T1 (see text).

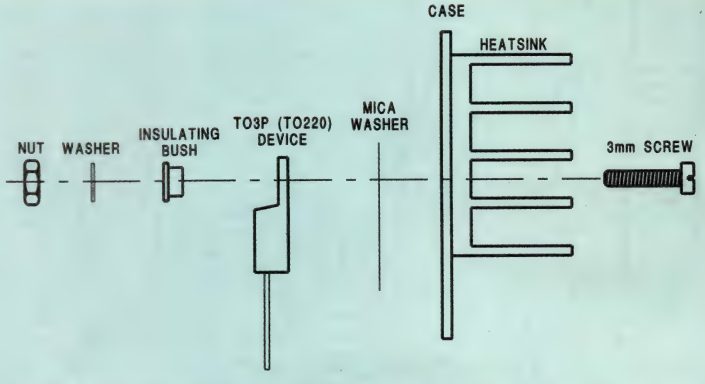


Fig.5: here are the mounting details for Mosfet (Q1) and the fast recovery diode (D1). They must be isolated from the case and the heatsink using TO-220 mounting kits.

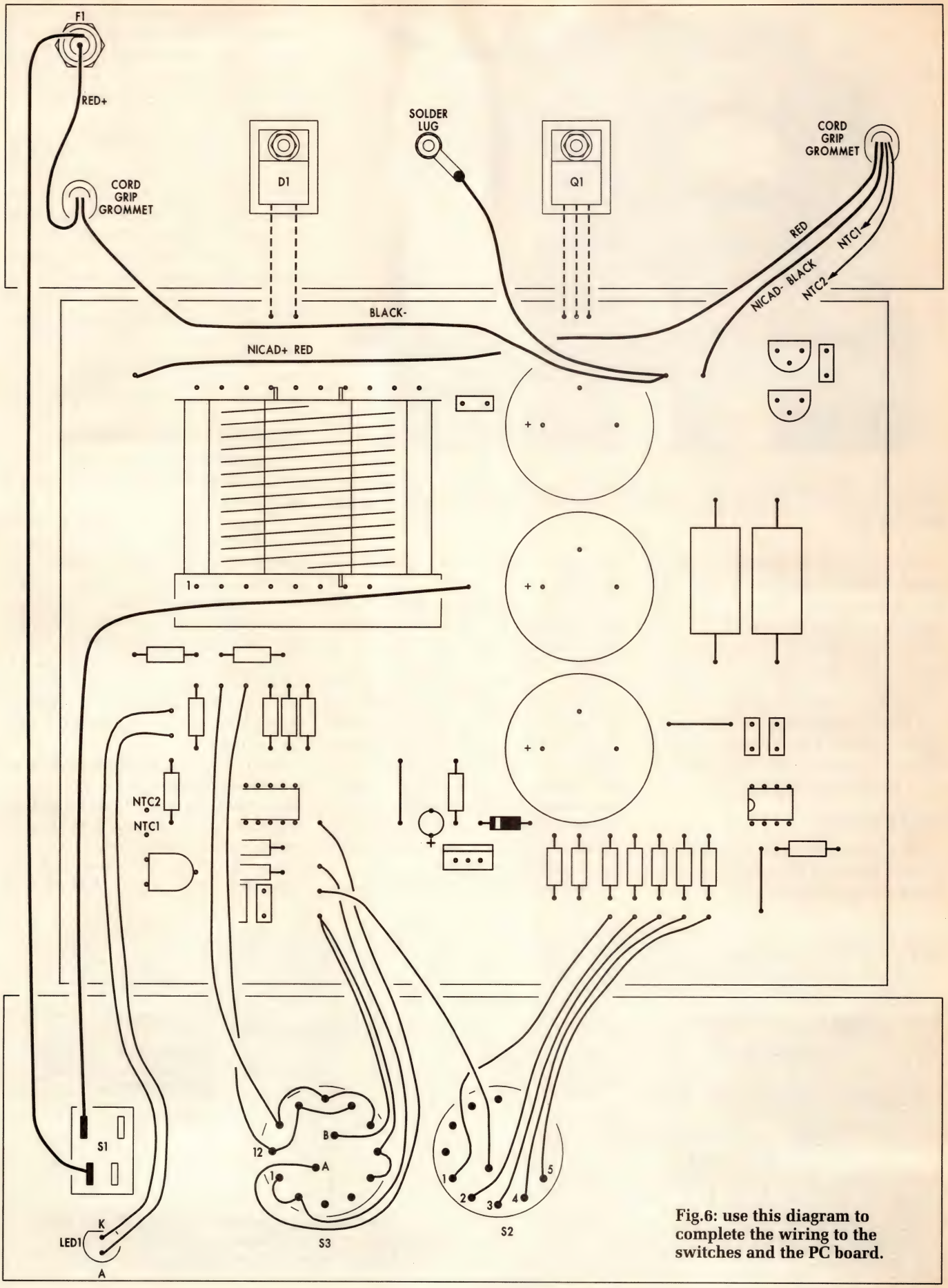
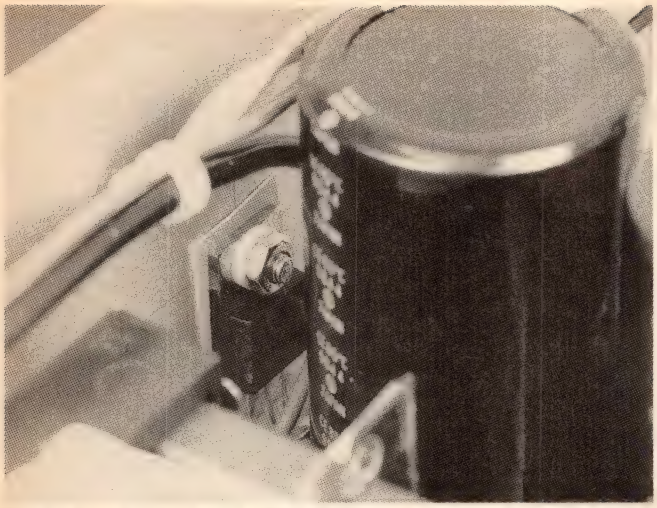
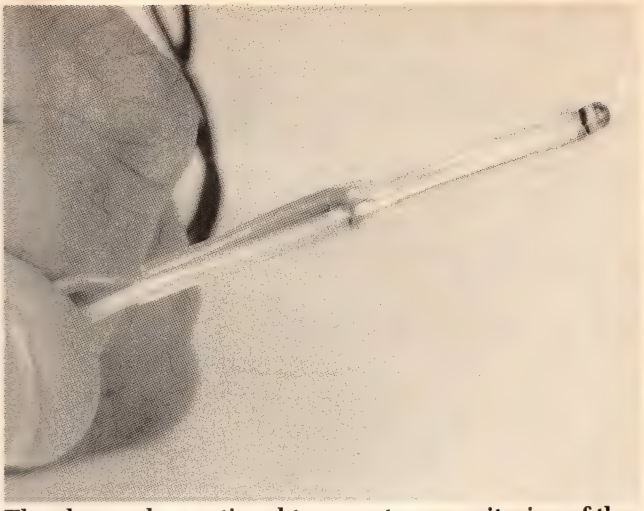


Fig.6: use this diagram to complete the wiring to the switches and the PC board.



Tucked in behind the 4700µF filter capacitors are the TO-220 Mosfet and fast recovery diode. The mounting details for these devices are shown in Fig.5.



The charger has optional temperature monitoring of the battery provided by a negative temperature coefficient (NTC) thermistor.

again finish with a layer of paper held with insulating tape.

The transformer can now be assembled by first inserting one ferrite core half into the bobbin and installing its metal retaining clip. The other ferrite core half is then inserted and 0.5mm spacers (eg, 4 x TO-220 mica washers) slid in between the two halves to provide an air gap (see photo). The second core half is then secured by installing its retaining clip.

Once the transformer assembly has been completed, it can be installed on the PC board. Make sure that pin 1 is adjacent to the 56kΩ resistor.

Final assembly

The Extra Fast Nicad Charger is housed in a plastic case measuring 204 x 68 x 157mm. An aluminium panel measuring 194 x 65mm and a finned heatsink (125 x 42 x 34mm) are fitted at the rear.

Position the PC board in the case and line up its mounting holes on the four integral standoffs at the corners. Use a large drill to shorten the unused standoffs so that the PC board will sit neatly in position. This done, secure the PC board in place with self-tapping screws, slide the metal panel into the slot at the rear of the case, and mark the positions for the Mosfet and diode mounting holes.

Next, drill these holes in the rear panel, along with holes for the two cordgrip grommets and the fuseholder. The heatsink is also secured with a screw and nut at its centre. After all the holes have been drilled, remove any burrs, particularly around the Mosfet and diode mounting holes, to prevent punch-through of the insulating washers.

The heatsink can now be secured to the rear panel using its central mounting screw. Fit an earth solder lug to this mounting screw and apply a smear of heatsink compound between the mating faces of the heatsink and rear panel before the final assembly.

Fig.5 shows the mounting details for the the Mosfet transistor and diode D1. They each need to be isolated from the panel using an insulating washer and bush. If you are using mica washers, use a smear of heatsink compound between the mating faces before final assembly. If silicone-impregnated glass fibre washers are used, no heatsink compound is necessary. When you have tightened down the

TABLE 1: RESISTOR COLOUR CODES

❑	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	1	220kΩ	red red yellow brown	red red black orange brown
❑	1	100kΩ	brown black yellow brown	brown black black orange brown
❑	2	56kΩ	green blue orange brown	green blue black red brown
❑	1	47kΩ	yellow violet orange brown	yellow violet black red brown
❑	1	27kΩ	red violet orange brown	red violet black red brown
❑	1	15kΩ	brown green orange brown	brown green black red brown
❑	1	6.8kΩ	blue grey red brown	blue grey black brown brown
❑	1	4.3kΩ	yellow orange red brown	yellow orange black brown brown
❑	1	3.9kΩ	orange white red brown	orange white black brown brown
❑	2	2.2kΩ	red red red brown	red red black brown brown
❑	1	2kΩ	red black red brown	red black black brown brown
❑	1	1.8kΩ	brown grey red brown	brown grey black brown brown
❑	1	1.1kΩ	brown brown red brown	brown brown black brown brown
❑	1	1kΩ	brown black red brown	brown black black brown brown
❑	3	10Ω	brown black black brown	brown black black gold brown

PARTS LIST

1 plastic case, 204 x 68 x 157mm
1 aluminium rear panel, 194 x 65mm
1 heatsink, 125 x 42 x 34mm
1 PC board, code 14309951, 171 x 140mm
1 self-adhesive front panel label, 190 x 60mm
1 Philips ETD49/25/16 transformer assembly:
2 4312 020 38041 3F3 cores;
1 4322 021 33882 bobbin;
2 4322 021 33922 clips
2 0.5 x 10 x 15mm spacers to gap transformer (eg, 4 TO-220 mica washers)
1 NTC thermistor (DSE Cat R-1797)
1 3AG panel fuse holder (F1)
1 10A 3AG fuse
1 SPST rocker switch (S1) (Altronics Cat S-3210)
1 single pole rotary switch (S2)
1 2-pole 6-position rotary switch (S3)
1 bezel to suit LED1
2 20mm diameter knobs
1 small cordgrip grommet
1 large cordgrip grommet
1 solder lug
2 TO-220 mounting kits
1 30A red alligator clip
1 30A black alligator clip
1 15-metre length 0.8mm enamelled copper wire
1 2-metre length automotive twin polarised cable
1 1-metre length red hookup wire
1 1-metre length black hookup wire
1 1-metre length yellow hookup wire
1 1-metre length green hookup wire
1 60mm length of 0.8mm tinned copper wire
19 PC stakes
2 25mm long x 3mm dia screws
6 cable ties

Semiconductors
1 TEA1100 nicad battery monitor (IC1)
1 7555 CMOS timer (IC2)
1 7808 3-terminal regulator (REG1)
1 IRF540 N-channel Mosfet (Q1)
1 BC338 NPN transistor (Q2)
1 BC328 PNP transistor (Q3)
1 MBR735 Schottky diode (D1)
1 16V 1W zener diode (ZD1)
1 5mm green LED (LED1)

Capacitors
3 4700µF 50VW PC electrolytic with support pin
1 100µF 16VW PC electrolytic
2 10µF 16VW PC electrolytic
1 1µF 16VW PC electrolytic
2 0.47µF MKT polyester
3 0.1µF MKT polyester
1 .033µF MKT polyester
1 .01µF MKT polyester
1 .0015µF MKT polyester
2 .001µF MKT polyester

Resistors (0.25W 1%)

1 220kΩ	1 3.9kΩ
1 100kΩ	2 2.2kΩ
2 56kΩ	1 2kΩ
1 47kΩ	1 1.8kΩ
1 27kΩ	1 1.1kΩ
1 15kΩ	1 1kΩ
1 6.8kΩ	3 10Ω
1 4.3kΩ	2 0.1Ω 5W

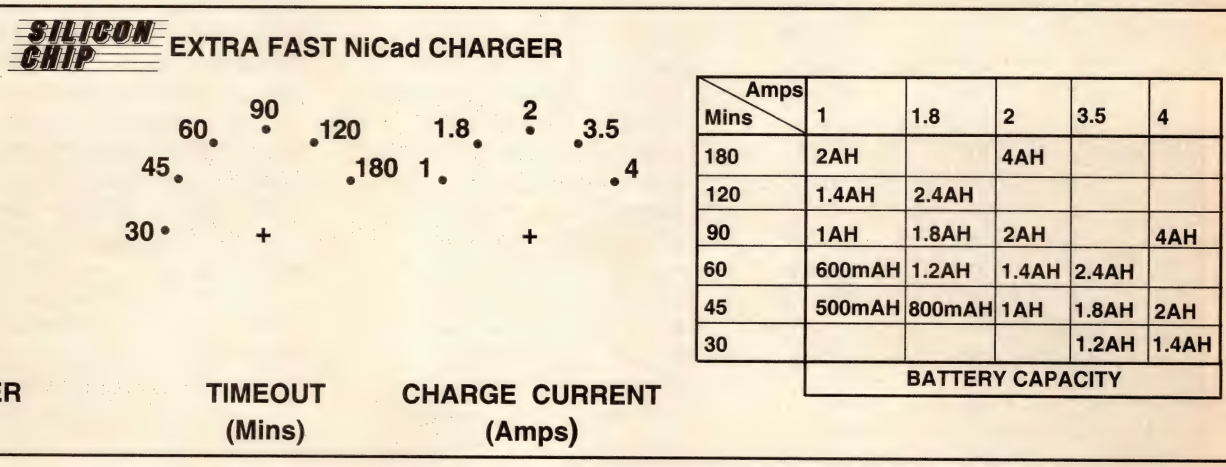
screw and nut, use a multimeter (set to a high "Ohms" range) to confirm that the metal tab of each device is correctly isolated from the panel.

Work can now be done on the front panel. Use the label as a guide for positioning the power switch, LED bezel and rotary switches. Drill out the holes for these items, then affix the label and cut out the holes with a sharp utility knife.

This done, mount the switches and LED bezel on the front panel and complete the wiring in the case. If the wires passing through each grommet on the rear panel are not gripped securely, use some heatshrink tubing to increase the cable diameter. Use cable ties to keep the wiring neat and tidy.

Terminate the 12V battery leads with 30A battery clips and the nicad leads with the correct plug for your battery. The thermistor can be permanently soldered to the NTC output lead or a small 2-pin connector plug connected to the lead end. In the first case, use heatshrink tubing on the leads to prevent shorts. In the second case, the thermistor is installed in the

Fig.7 (below): this full size artwork can be used as a drilling template for the front panel.



Amps / Mins	1	1.8	2	3.5	4
180	2AH		4AH		
120	1.4AH	2.4AH			
90	1AH	1.8AH	2AH		4AH
60	600mAH	1.2AH	1.4AH	2.4AH	
45	500mAH	800mAH	1AH	1.8AH	2AH
30				1.2AH	1.4AH
	BATTERY CAPACITY				

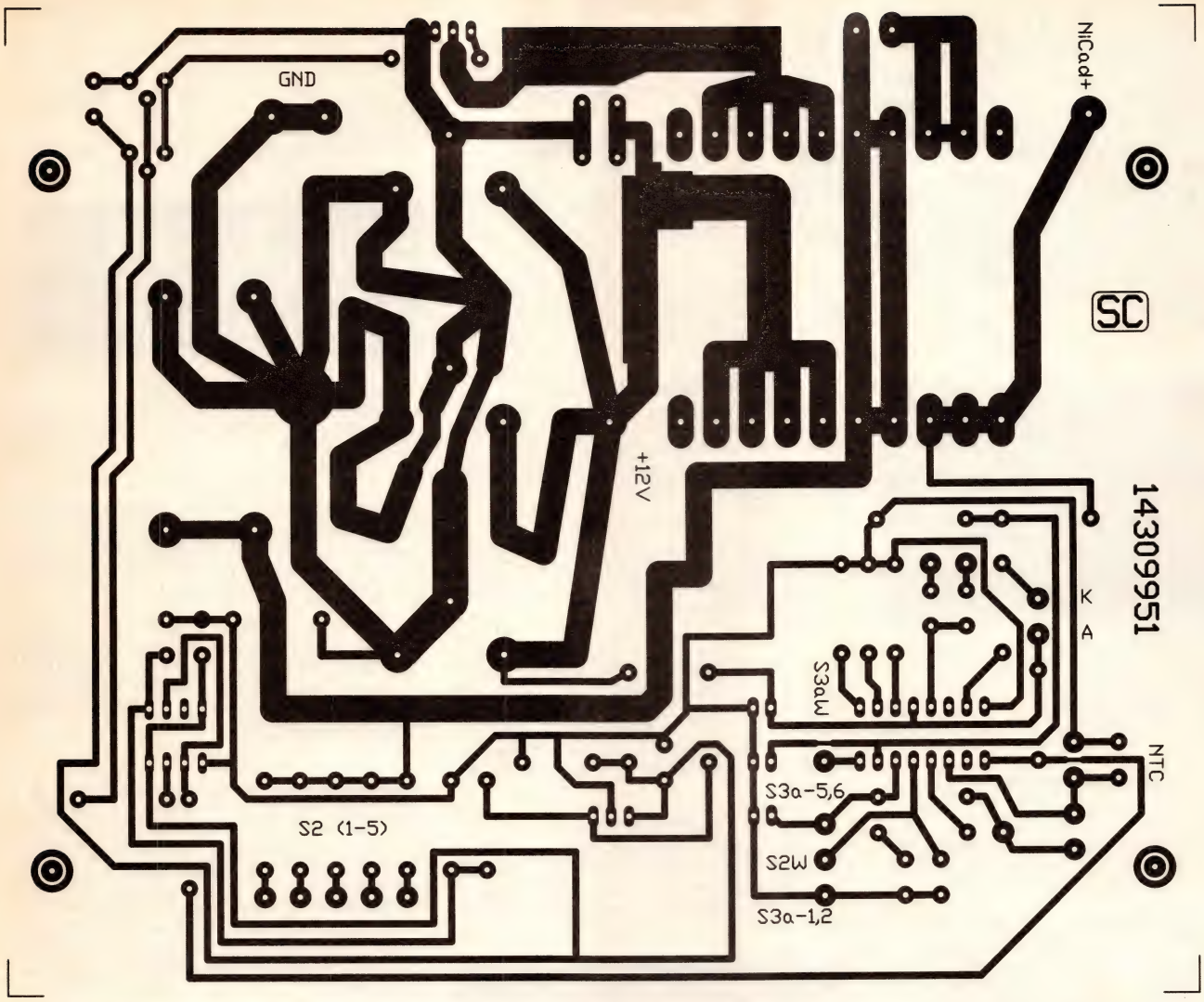


Fig.8: this is the full size artwork for the PC board. Check your board carefully for possible etching defects before installing any of the parts.

nicad battery package with a corresponding 2-pin socket ready for connection every time the nicad is to be charged. Fit a short length of heatshrink tubing over the thermistor to prevent it shorting to the nicad case.

If the thermistor is not permanently installed inside the nicad pack, we recommend using either masking tape or an elastic band to hold it in contact with the cells during charging.

Testing

Apply 12V to the input terminals and check that there is +8V between pins 12 and 16 of IC1. There should also be about +4.2V at pin 6 and +12V at pins 4 and 8 of IC2. The LED should be glowing dimly. If not, check the fuse and your component placement and wiring. If the transformer makes a high pitched squeal, check the transformer windings – they are probably wound with incorrect phase.

Short out the nicad battery output leads and check that the LED flashes. The standby current with the nicad output leads shorted is about 16mA.

Now the unit is ready to test by charging a battery. Switch off the power and connect a discharged nicad battery to the output leads. Select the requisite timeout period and charge current. Apply power and check that the battery charges within the allotted time. Note that the charger will not operate if the NTC output leads are disconnected from the thermistor.

During charging at the higher current levels, the heatsink and transformer windings will run hot. This is normal. **SC**

Specifications

Maximum charge current	4A
Charge current ranges (A)	4, 3.5, 2, 1.8, 1
Charging times (mins)	30, 45, 60, 90, 120, 180
-dV detection	1%
Trickle charge current	5% of main charge current for 30 and 45 mins timeout; 2.5% for 60 and 90 mins timeout; 1.25% for 120 and 180 mins timeout
Thermistor cutout temperature	<45°C
Input voltage	11-14VDC

OATLEY ELECTRONICS

PO Box 89, Oatley, NSW 2223
Phone (02) 579 4985 Fax (02) 570 7910
Bankcard, Master Card, Visa Card & Amex accepted with phone & fax orders. P & P for most mixed orders: Aust. $4-$10; NZ (airmail) $10. Orders by EMAIL: oatley@world.net

NOVEMBER 4 SALE

Our once a year sale is on again! Once again we will have a sale at our premises on Saturday, November 4th 1995 at 7 LANSDOWNE PDE., OATLEY. We will have mail order specials and many bargains at the sale. You can obtain a price list for many of the items offered by polling 02 9 5793983. Mail orders will be accepted up to 1 week after the sale. Allow up to two weeks for delivery.

HALOGEN TRANSFORMERS

Compact (41x66x30mm) metal boxed electronic transformers. 95%eff. 25KHz. Mains powered and designed to power up to 50W of 12V halogen/incandescent lamps. Not approved, sold for components/experimentation: **$6 ea. or 4 for $20.**

IMAGE INTENSIFIER TUBES

Back in stock! Used but in excellent condition, second generation image intensifier tubes. Can be used to make small and very sensitive scopes that can produce high resolution pictures in as little as starlight illumination. US made tubes that produce superior results!: **$650**.

$205 CCD SECURITY SYSTEM

Low light monochrome CCD camera which is totally assembled on a small PCB and includes an auto iris lens. Overall dimensions are 38 x 38 x 27mm. Can be used in total darkness with infrared illumination: **$180**. We can also provide a kit for a VHF MODULATOR - AUDIO AMPLIFIER. This kit enables any TV to serve as good quality monitor. The audio amplifier section can be used for listening for sounds in the secured area. The PCB and components kit (microphone included) for this kit plus a suitable plugpack that can power the camera and the kit is priced at **$25** when purchased in conjunction with a camera. You can also purchase a combination that includes a CCD camera and one of our commercial UHF transmitters (see separate advertisement) for a total reduced price of **$199**.

LOW COST IR ILLUMINATOR KIT

Compact PCB (52 x 83mm) employs 42 high output 880nM IR LEDs (30mW @ 100mA ea.) and a 7 transistor adjustable constant current driver circuit. Designed to be powered from 10-14V DC, current depends on power level setting: 5-600mA. Good for illuminating IR responsive CCD cameras, IR and passive night viewers, and medical use. PCB and components kit: **$40**.

FAX LENSES

Small precision lens assembly as used in fax machines. Cylindrical construction: 32mm long x 25mm diam. Contains 4 high quality lenses. **$5.50**.

MOTOR DRIVEN VOLUME CONTROL

BRAND NEW high quality motor driven potentiometer, like those used in commercial stereo sound systems. Includes a clutch, so it can also be manually adjusted. Standard 1/4" shaft, stereo (dual 100k pots) with 5V, 20mA motor. Special introductory price: **$15**. A low cost UHF remote control kit for this unit will soon be available. Add a remote controlled volume system to an old TV or stereo. The controller can also be used to drive electromechanical devices via relays. Kit includes 2ch UHF Tx, Rx module, PCB motor driven pot or relays, PCB and all on board components. Approximate price **$50!!**

ELECTROCARDIOGRAM

July EA 95. This project requires no specialised parts. Short form kit includes solder masked, silk screened PCB and all software on 3.5" disk: **$9**.

ARGON ION LASERS

US made Argon Ion laser heads with connecting leads and matching 110V AC power supplies. Multiline units in good condition that produce 40mW + outputs: **$2200 ea.**

MASTHEAD AMPLIFIER SPECIAL

High performance low noise masthead amplifier covers VHF/FM/UHF and is based on a MAR-6 IC. Includes two PCBs, all on-board components. For a limited time we will also include a suitable plugpack to power the amplifier from mains for a total price of: **$25**.

SPRING REVERB

Large studio quality, six-spring reverberation units. Overall dimensions 425x110x33mm, input Z = 190 ohms, output Z = 2.6k ohms, recommended AC drive = 6.5 mA. **SPECIAL INTRODUCTORY PRICE: $45.**

TOMINON HIGH POWER LENS

These 230mm (1:4.5) lens have never been used. They contain six coated glass lenses, symmetric, housed in a black aluminium case. Scale range is from 1:10 through to 1:1 to 10:1. Applications include high quality image projection at macro scales, and portrait photography in large formats. **$45**.

PROJECTION LENS

Brand new, precision angled projection lens. Overall size is 210 x 136mm. High-impact lexan housing with focal length adjustment lever. When disassembled, this lens assembly yields three 4" diameter lenses (concave, convex-concave, convex-convex). Very limited quantity: **$35**.

GEIGER COUNTER – TUBES

These ready-made Geiger Counters detect dangerous Beta and Gamma rays. Have 2-mode LCD display, alarm buzzer, low-power battery operation (15mW): $99 for the complete counter or $45 for just the tube that's used in these counters. Will work from 500V.

LASER POINTER

Brighter than most, due to the use of a high quality lens. 5mW/670nM output. Operates from two small "N" cells: Included. Also suitable for medical uses: **$75**.

AIR COOLED ARGONS

Used Argon/Ion heads with 30-100mW output in the blue/green spectrum. Priced at around **$350** for the "head" only, power supply circuit and information supplied. LIMITED SUPPLY.

LIGHT MOTION DETECTORS

Small PCB assembly based on a ULN2232 IC. This device has a built in light detector, filters, timer, narrow angle lens, & even a siren driver circuit that can drive an external speaker. Will detect humans crossing a narrow corridor at distances up to 3 metres. Much higher ranges are possible if the detector is illuminated by a remote visible or IR light source. Can be used at very low light levels, and even in total darkness: with IR LED. Full information provided. The IC only, is worth $16! **OUR SPECIAL PRICE FOR THE ASSEMBLY IS: $5 ea. or 5 for $20.**

LOW COST PIR KIT

This PIR movement detector is based on single LSI IC design and features simple construction. Even the lens assembly snaps onto the PCB. The dome lens assembly makes the detector also suitable for use as a ceiling PIR detector. Has every imaginable feature: negligible power consumption, optional/adjustable daylight disable with LDR light detector supplied, 10m range, variable alarm time, disable input, 10A MOSFET output, 10-20V DC operation. Fits into the smallest zippy box! A complete PCB and all on-board components kit is available for only: **$20**.

FLUORESCENT LIGHTING SPECIAL

A 12V-350V DC-DC converter (with larger MOSFETS) plus a dimmable mains operated HF ballast. This pair will operate a 32-40W fluorescent tube from a 12V battery: very efficient. See June 95 EA: $36 for the kit plus the ballast.

40mW IR LASER DIODES

New famous brand 40mW-830nM IR laser diodes, suit medical and other applications: **$60 ea.**, constant current driver kit to suit: **$10**.

AC MOTOR

Small but very powerful GEARED AC motor. 1 RPM/60Hz/24V/5watt. We supply a circuit diagram that shows how to power this motor from 12V DC: variable speed/full power (bridge output). Bargain priced: **$9**. PCB and all on-board components kit for the 12V driver kit: **$8**.

DOT MATRIX LCDs

Brand new Hitachi LM215 400 x 128 dot matrix Liquid Crystal Displays in an attractive housing. These have driver ICs fitted but require an external controller. Effective display size is 65 x 235mm. Available at less than 10% of their real value: **$25 ea. or 3 for $60**.

OPTICS

USSR LENS 100mm-f2 Pentax screw mount thread, as used for night viewers, has focus adj. but no iris adj.: $60. **USSR LENS** 58mm-f2 Pentax screw mount lens as used for cameras, has focus and iris adj.: $60. **BEAM SPLITTER** for 633nM: $45. **PRECISION FRONT SURFACE ALUMINIUM MIRRORS** 200 x 15 x 3mm: $3; 50 x 72 x 3mm: $3. **LINE GENERATING OPTIC** makes a line out of a laser beam: $5. **LASER DIODE COLLIMATING LENS:** $4. **PORRO 90 deg. PRISM** makes a rainbow from white light: $10. **ARGON MIRRORS** high reflector and output coupler used to make a Argon tube: $50.

27MHz TRANSMITTERS

New transmitters are assembled (PCB assy.) and tested. They are Xtal locked on 26.995 MHz and were originally intended for transmitting digital information. Their discrete component design employs many components, including 5 transistors and 8 inductors. Circuit provided. A heatsink is provided for the output device. Power output depends on supply voltage and varies from 100mW to a few watts, when operated from 3-12V DC. These are sold for parts/experimentation/educational purposes, and should not be connected to an antenna as licensing may be required: **$7 ea. or 4 for $20**.

VISIBLE LASER DIODE KIT

A 5mW/660-670nM visible laser diode (very bright!!) plus a collimating lens, plus a housing, plus an APC driver kit (Sept. 94 EA) UNBELIEVABLE PRICE: **$40**. Housing plus battery holder plus switch $5 extra.

STEREO SPEAKER SETS

A total of four speakers to suit the making of two 2 way speakers (stereo). The bass-midrange speakers are of good quality, European made, with cloth surround, as used in upmarket stereo televisions: rectangular, 80 x 200mm. The tweeters are good quality cone types: square, 85 x 85mm. Two woofers and two tweeters: $16.

LOW COST 1-2 CHANNEL UHF REMOTE CONTROL

A 304MHz UHF remote control with over 1/2 million code combinations which also makes provision for a second channel expansion. The low cost design features keyring

size transmitter kits that include a case and battery, and a PCB and components kit for the receiver that has 2A relay contact outputs!. 1ch Tx kit: $10, 2ch Tx kit: $16, 1ch Rx kit: $20, extra components for 2 channel Rx operation (extra decoder IC and relay): **$6**.

3 STAGE NIGHT VIEWER KIT

See SC Sept. 94. We have accumulated a good number of 40mm three stage fibre optically coupled 3 stage image intensifiers that have minor blemishes. The three tubes are supplied already bonded together: extremely high gain!! We can supply this 3 stage tube plus a power supply kit plus a lens and an eyepiece for a total cost of **$250**. That is an almost complete starlight night viewer kit! We can also supply the full SC Sept. 94 Magazine: $5.

VISIBLE LASER DIODE MODULES

Industrial quality 5mW/670nM Laser diode modules. Overall dimensions: 11mm diameter by 40mm long. Have APC driver built in and need approximately 50mA from 3-6V supply: **$60**.

VIDEO TRANSMITTERS

Low power PAL standard UHF TV transmitters. Have audio and video inputs with adjustable levels, a power switch, and a power input socket: 10-14V DC/10mA operation. Enclosed in a small metal box with an attached telescopic antenna. Range is up to 10m with the telescopic antenna supplied, but can be increased to approximately 30m by the use of a small directional UHF antenna. **INCREDIBLE PRICING: $25.**

12V FANS

Brand new 80mm 12V-1.6W DC fans. These are IC controlled and have four different approval stamps: **$10 ea. or 5 for $40**.

NEW - PHOTOGRAPHIC KITS

SLAVE FLASH - very small, very simple, very effective. Triggers remote flashes from camera's own flash to fill in shadows. Does not false trigger and it is very sensitive. Can even be used in large rooms. PCB and components kit: $7.
SOUND ACTIVATED FLASH - Adapted from ETI Project 514. Adjustable sensitivity & delay enable the creation of some fascinating photographs. Has LED indicator that makes setting up much easier. PCB, components, plus microphone: $13.

TDA ICs/TRANSFORMERS

We have a limited stock of some 20 Watt TDA1520 HI-FI quality monolythic power amplifier ICs: less than 0.01% THD and TIM distortion, at 10W RMS output! With the transformer we supply we guarantee an output of greater than 20W RMS per channel into an 8ohm load, with both channels driven. We supply a far overrated 240V-28V/80W transformer, two TDA1520 ICs, and two suitable PCBs which also include an optional preamplifier section (only one additional IC), and a circuit and layout diagram. The combination can be used as a high quality HI-FI Stereo/Guitar/PA, amplifier. Only a handful of additional components are required to complete this excellent stereo/twin amplifier! **Incredible pricing: $25 for one 240V-28V (80W!) transformer, two TDA1520 monolythic HI-FI amplifier ICs, two PCBs to suit, circuit diagram/layout.** Some additional components and are heatsink are required.

SOLID STATE "PELTIER EFFECT" DEVICES

These can be used to make a solid state thermoelectric cooler/heater. Basic information supplied. **12V-3.4A PELTIER: $25; 12V-4.5A PELTIER: $35.** We can also provide two thermal cut-out switches, and a 12V DC fan to suit either of the above, for an additional price of $10.

TWO STEPPER MOTORS PLUS A DRIVER KIT

This kit will drive two stepper motors: 4, 5, 6 or 8 wire stepper motors from an IBM computer parallel port. Motors require separate power supply. A detailed manual on the COMPUTER CONTROL OF MOTORS plus circuit diagrams/descriptions are provided. We also provide the necessary software on a 5.25-inch disc. Great "low cost" educational kit. We provide the kit, manual, disc, plus TWO 5V/6 WIRE/7.5 Deg. STEPPER MOTORS FOR A **SPECIAL PRICE OF $42**.

PIR MODULE

These multipurpose industrial quality US made PIR modules have 64 look out beams and a 180 degree field of view! Very low current consumption (150uA), 4-6V operation, will operate a buzzer directly or a relay via a single transistor switch, 4-20um spectral response. Will detect humans at up to and over 6 metres. Very small. Overall dimensions are 38 x 25 x 33mm. $14. One of many applications: make a SHOP ENTRY DETECTOR by just adding a buzzer: $2.50.

12V-2.5 WATT SOLAR PANEL KITS

These US made amorphous glass solar panels only need terminating and weather proofing. We provide terminating clips and a slightly larger sheet of glass. The terminated panel is glued to the backing glass, around the edges only. To make the final weatherproof panel look very attractive some inexpensive plastic "L" angle could also be glued to the edges with some silicone. Very easy to make. Dimensions: 305 x 228mm, Vo-c: 18-20V, Is-c: 250mA. **SPECIAL REDUCED PRICE: $20 ea. or 4 for $60.** Each panel is provided with a sheet of backing glass, terminating clips, an isolating diode, and the instructions. A very efficient switching regulator kit is available. Suits 12-24V batteries, 0.1-16A panels, $27. Also available is a simple and efficient shunt regulator kit, **$5**.

VEHICLE COMPUTERS

Originally designed for bicycles, but these suit any moving vehicle that has a rotating wheel! A nine function computer with speed, average speed, maximum speed, distance, odometer, timer, scan, freeze frame memory, and a clock. Its microprocessor based circuitry can be adapted to work with almost any wheel diameter. Simply divide the wheel diameter in millimetres by 6.8232, and program the resultant figure into the computer. **$29.90.**

HELIUM - NEON LASER BARGAIN

Helium Neon 633nM red laser tubes that were removed from new and near new equipment. These are suitable for light shows. Output power is in the range of 2.5-7.5mW. With each of the tubes we will include our 12V Universal Laser power supply MKIV. (No problems with our new transformers.) ON SPECIAL at a reduced price of: $80 for a 2.5-4.0mW tube and supply. $130 for a 4.0-7.5mW tube and supply.

MORE KITS

MODEL TRAIN CONTROLLER: run two trains on one track without any collisions, uses kit IR LEDs/transistors for detectors (supplied), doubles up as a crossing controller with flashing crossing LEDs. Incredible pricing: $20. **TRAIN SOUND GENERATOR:** can be used in conjunction with the controller to produce crossing & other sounds, when a train is on a particular part of a track: $12. **4 CHANNEL UHF REMOTE CONTROL KIT:** two transmitters & one receiver: $96. **GARAGE/DOOR/GATE REMOTE CONTROL KIT:** SC Dec. 93: Tx $18, Rx $79. **1.5-9V CONVERTER KIT:** $6 ea. or 3 for $15. **LASER BEAM COMMUNICATOR KIT:** Tx, Rx, plus IR Laser: $60. **ELECTRIC FENCE KIT:** PCB & components, includes prewound transformer: $40. **PLASMA BALL KIT:** PCB & components kit, needs any bulb: ON SPECIAL $20. **BRAKE LIGHT INDICATOR KIT:** 60 LEDS, two PCBs & ten Rs, makes for a very bright 600mm long high intensity red display: ON SPECIAL $25. **FM TRANSMITTER KIT - MKII:** high quality - high stability, suit radio microphones & instruments, 9V operation, the kit includes a PCB & all the on-board components, an electret microphone, & a 9V battery clip: $11. **FM TRANSMITTER KIT - MKI:** this complete transmitter kit (miniature microphone included) is the size of a "AA" battery, & it is powered by a single "AA" battery. We use a two "AA" battery holder (provided) for the case, & a battery clip (shorted) for the switch. Estimated battery life is over 500 hours!!: $11. **PROTECT ANYTHING ALARM KIT:** EA May 93, ON SPECIAL, PCB and all on-board components kit: $20. **ELECTRIC FENCE KIT:** SC Apr. 94: ON SPECIAL: $28. **ELECTRONIC KEY KIT:** EA July 92, 2 keys plus one receiver, ON SPECIAL: $30.

MORE ITEMS

ELECTROMAGNETS: 12V-200 mA: 3 for $2. **PRINTER MECHANISMS:** new Epson dot matrix printer mechanisms, overall dimensions are 150 x 105 x 70mm: $12. **SWITCHED MODE POWER SUPPLIES:** mains in (240V), new assembled units with 12V-4A and 5V-4A DC outputs: $32. **INDUCTIVE PROXIMITY SWITCHES:** detect ferrous and non-ferrous metals at close proximity, AC or DC powered types, three wire connection for connecting into circuitry: two for the supply, and one for switching the load, these also make excellent sensors for rotating shafts etc.: $22 ea. or 6 for $100. **IEC EXTENSION LEADS:** 2m long, IEC plug at one end, IEC socket at other end: $5. **MOTOR SPECIAL:** type M9: 12V, I No load = 0.52A-15,800 RPM at 12V, 36mm diam.-67mm long: $5; type M14: made for slot cars, 4-8V, I No load = 0.84A at 6V, at max efficiency I = 5.7A-7500 RPM, 30mm diam.-57mm long: $5. **EPROMS:** 27C512, 512K (64K x 8), 150nS Access CMOS EPROMS, removed from new equipment, need to be erased, guaranteed: **$4**. **EHT POWER SUPPLY:** out of new laser printers, deliver -600V, -7.5kV and +7kV when powered from a 24V-800mA DC supply, enclosed in a plastic case: $16. **MAINS CONTACTOR RELAY:** has a 24V-250ohm relay coil, and four separate SPST switch outputs, 2 x 10A and 2 x 20A, new Omron brand, mounting bracket and spade connectors provided: CLEARANCE @ $5 ea. **SUPERCAPS:** 0.047F/5.5V capacitors: 5 for $2. **WELLER SOLDERING IRON TIPS** new tips Weller stations and mains operated Weller irons, mixed popular types, specify mains or station type: 5 for $10. **LCD CHARACTER DISPLAYS:** standard 16 x 1 displays, 5V operation: $20. **USED HF BALLASTS:** these extremely efficient flickerless units will power two 32-40W fluorescent tubes from mains: $10 ea. or 3 for $20.

SINGLE CHANNEL UHF WITH CENTRAL LOCKING

Our single channel UHF receiver kit has been updated to allow provision for central locking! Features key chain transmitter and a receiver that includes a prebuilt UHF receiver module. Receiver has provision for four relays: switch, indicator and two central locking relays. The basic receiver kit is provided with a PCB, all "on-board" components plus two relays: $36. Additional relays for central locking $3 ea. Transmitter kit $18.

COMPONENTS

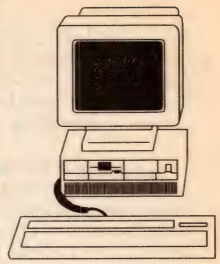
HIGH INTENSITY RED LEDs: 550-1000mCd @ 20mA, 100mA max, 5mm housing: 10 for $4, or 100 for $30. **BLUE LEDs:** 5mm: $2.50. **ELECTRET MICROPHONE INSERTS:** high output standard size omnidirectional: 10 for $8. Also some high quality unidirectional electrets that were removed from new equipment: $3 ea. **ULTRASONIC TRANSDUCERS:** high quality Murata 40KHz transmitter and receiver transducers: $4 pr., 40KHz Xtal to suit: $2. **3.57MHz XTALS:** 10 for $6. **OP27 OPERATIONAL AMPLIFIERS:** super operational amplifier ICs!: $3 ea. **ENCODER DECODER ICs:** as used in many projects, SC Dec. 92, EA Mar. 93 and 94, AX526/7/8 ICs: $3.50 ea. UHF Module to suit: $15. **DYNAMIC MICROPHONE INSERTS:** Unidirectional low impedance inserts: $4 ea. **HIGH VOLTAGE DISC CERAMICS:** 680pF-3kV: 20 for $4, 0.015uF-3kV: $2 ea. **HIGH VOLTAGE DIODES:** all are very fast!, 1kV-1A: 10 for $5, 8kV-20mA: $1.50, 16kV-20mA: $2 ea. **GAS FILED ARRESTORS:** 10 for $3. **THERMISTORS:** 2.5ohm NTC: 10 for $2. **TRIACS:** 600V-60A, CLEARANCE: $3 ea. **COMPRESSION TRIMMER:** 250pF, mica dielectric, new but may be slightly soiled, ceramic base: $1 ea.

MORE IR COMPONENTS

880nm/12 deg./30mW @ 100mA IR LEDs: 10 for $9
880nm/60deg./30mW @ 100mA IR LEDs: 10 for $9
940nm/12deg./16mW @ 100mA IR LEDs: 10 for $5
IR DETECTOR PIN DIODE: 10 for $10
5mW/780 nm Laser diode (LTO26): $16 ea.

COMPUTER BITS

BY GEOFF COHEN
gcohen@pcug.org.au



Making the Internet connection

Microsoft's new Windows 95 includes software for accessing the Internet. Here's a look at how it all works.

It seems that every time you open a newspaper or magazine there is an article on the Internet but they aren't all that helpful in telling you what you need to get on-line. The popular press can't seem to talk about anything except censorship, while the computer magazines do not usually describe exactly how to make the connection, from the point of view of a normal PC user who has little or no on-line experience.

This article remedies that situation. Before going into the details, however, we'll give a brief background on the Internet.

The Internet (or Net) is the largest computer network in the world, with over 4,000,000 computers connected to it. Most PC users, except for the lucky ones who have network connections at their work or university, connect to the Net using a modem via one of the many Internet Service Providers (ISP). The Net gives access to a staggering amount of information and provides functions such as newsgroups (Usenet), file transfer (both downloading and uploading), email and chat facilities (for "talking" to other Net users).

How do I connect

Whether you like it or not, Microsoft's new Windows 95 is the operating system that the vast majority of PCs will be using in the future. And because it includes the necessary networking software, a large proportion of PC users will inevitably connect to the Internet from Windows 95 via the Microsoft Network (MSN).

Personally, after using a preview (beta) version of Windows 95 for a few weeks, and despite some of my friends saying that I need to see a shrink, I definitely prefer it to Windows 3.11. A caveat though – I am not as impressed with the software for the Microsoft Network and I still prefer Netscape as an Internet navigator. However, I will concentrate on Microsoft's offering in this column.

What hardware do you need to get onto the Internet?

If you are going to use Windows 95 to connect to the Internet via the Microsoft Network, the minimum system you should use, without having a *verrrrry* slow system would be:

- Processor: 486DX2-66 CPU
- Memory: 8Mb RAM (12-32Mb preferred)
- Hard Disc: 250Mb absolute minimum, with 500Mb-1Gb really needed for Win 95 and Office 95.

At the moment, I am using a Pentium 100 system with 32Mb RAM, a 4Gb Seagate SCSI-II hard disk, a 17-inch monitor and a 4Gb DAT tape backup. On this system, Win 95 runs very nicely indeed but this much power is not really needed. My other PC is a 486DX2-66 with 12Mb RAM and the performance is slower but still quite acceptable. I use an old fashioned mechanical switch box to allow either PC to use the modem (I really should do this in software sometime but perhaps it is another case of better never than late).

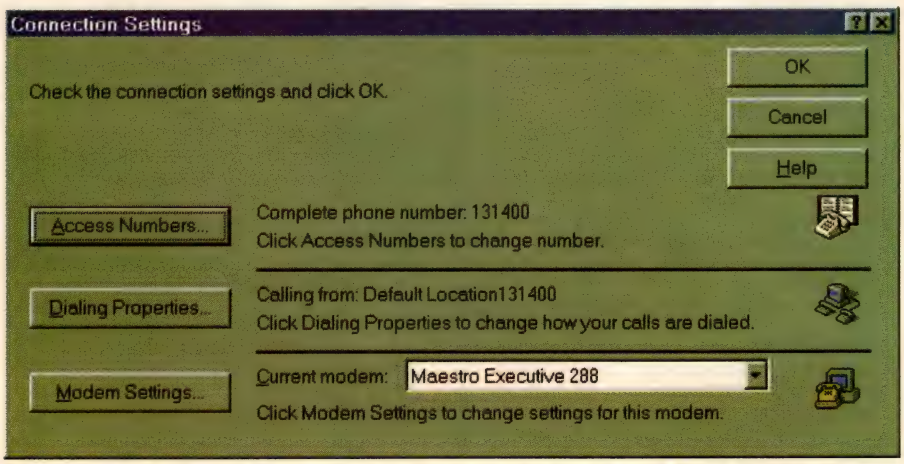

Connection Settings
Check the connection settings and click OK.
OK
Cancel
Help
Access Numbers...
Complete phone number: 131400
Click Access Numbers to change number.
Dialing Properties...
Calling from: Default Location131400
Click Dialing Properties to change how your calls are dialed.
Modem Settings...
Current modem: Maestro Executive 288
Click Modem Settings to change settings for this modem.

Fig.1: you can change the modem settings at any time by clicking on "Modem Settings" in the control panel.

Modems

One essential item of hardware is a modem. I would not recommend buying a modem that is slower than 28,800 bps and would strongly suggest buying a V34 modem. I am currently using a VFAST modem (Maestro 288FM, 28,800 bps) but I am going to upgrade it to V34, as the VFAST protocol does not always connect at it's maximum speed when dialling some brands/models of modems.

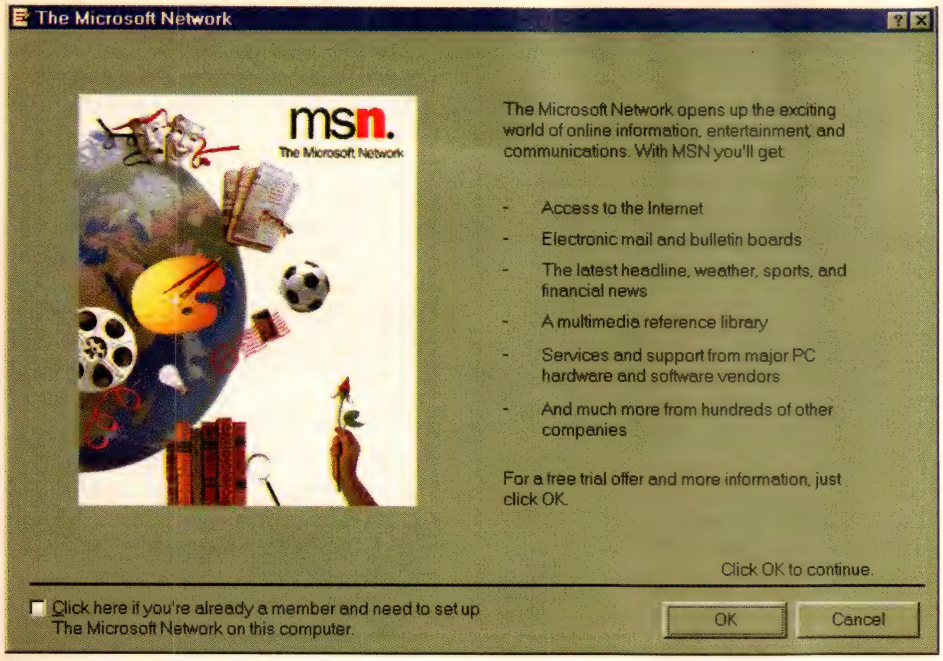

The Microsoft Network
msn.
The Microsoft Network
The Microsoft Network opens up the exciting world of online information, entertainment, and communications. With MSN you'll get:
- Access to the Internet
- Electronic mail and bulletin boards
- The latest headline, weather, sports, and financial news
- A multimedia reference library
- Services and support from major PC hardware and software vendors
- And much more from hundreds of other companies
For a free trial offer and more information, just click OK.
Click OK to continue.
Click here if you're already a member and need to set up The Microsoft Network on this computer.
OK
Cancel

Fig.2 (left): this is the opening screen when you first log onto the Microsoft Network.

On the other hand, V34 is now a worldwide standard and should always connect at full speed (assuming a good phone line, of course). Fortunately, it is relatively cheap to upgrade my Maestro from VFAST to V34. Of course, a modem from Netcom or any other major manufacturer will also be OK (I always try to buy Australian).

Setting up Win 95

After you have (probably) spent large sums of money upgrading your system and have Windows 95 up and running, you need to set up "The Microsoft Network". The setup Wizard that comes as part of the software covers this quite well.

The Wizard will first ask you to set up your modem by clicking on Yes in a control panel. In my case, the Wizard only found a "Standard Modem", so I clicked on "Change" and manually selected my modem from the list. This ensures that the maximum speed of the modem is selected.

The Wizard is also useful as it finds the correct serial port. If necessary, you can change the modem settings at any time by clicking on "Modem Settings" in a control panel (see Fig.1).

Next, if not already done, you will be asked to set up the Microsoft Exchange. Select "The Microsoft Network" and if you have a Fax/Modem it's a good idea to select "Microsoft Fax". Unless you are on a network and have Microsoft Mail, I recommend that you do not tick "Microsoft Mail".

When "The Microsoft Network" icon appears, answer the questions. Note that what the Americans call the "Area or City code" we call the STD code. Also you should select the Nationwide 131400 number – this is a bit slow at 9600bps but is going to be upgraded to 14,000 very soon and to 28,800 early next year.

When you connect to MSN this first time, a screen appears to tell you what is happening and the software downloads a form. You then have to fill out your personal details, as well as your credit card details, so Microsoft can get their pound (or is it kilogram now?) of flesh and charge you each month for your on-line access time. This is currently $5.00 per hour plus the local phone call to connect to MSN.

When you have answered all the questions, I strongly recommend that you write down the Logon name and Password you selected. If you are sure no unauthorised person will use your account, tick the "Remember My Password" box (this saves a lot of hassles

Fig.3: this is the main Microsoft Network screen (Microsoft Central).

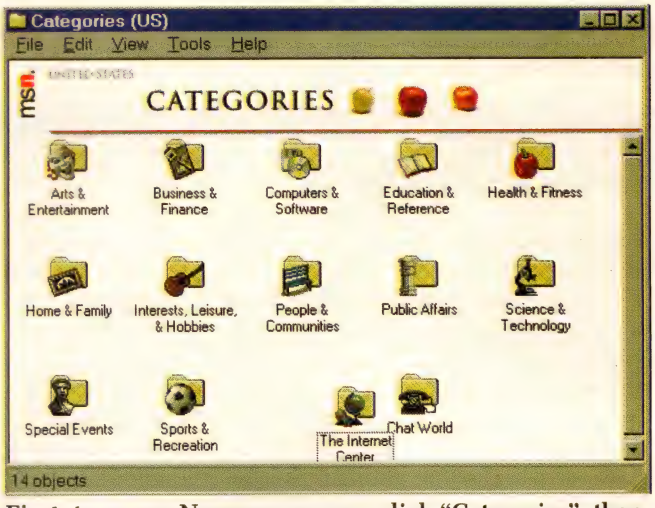


Fig.4: to access Newsgroups, you click "Categories", then "The Internet Center" and browse to your heart's content.

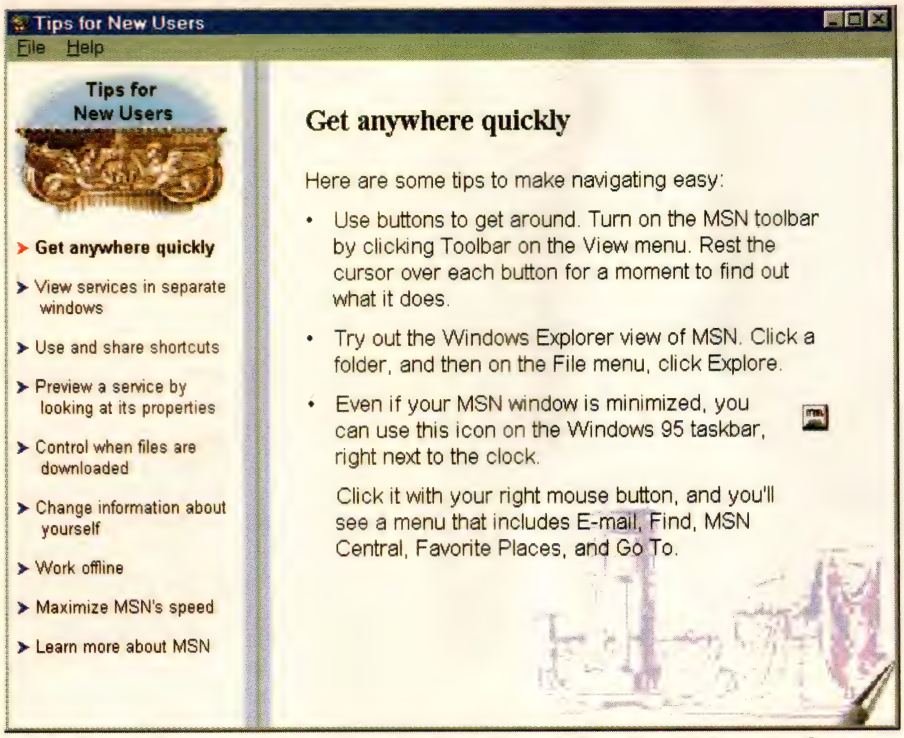

Tips for New Users
File Help
Tips for New Users
Get anywhere quickly
View services in separate windows
Use and share shortcuts
Preview a service by looking at its properties
Control when files are downloaded
Change information about yourself
Work offline
Maximize MSN's speed
Learn more about MSN
Get anywhere quickly
Here are some tips to make navigating easy:
• Use buttons to get around. Turn on the MSN toolbar by clicking Toolbar on the View menu. Rest the cursor over each button for a moment to find out what it does.
• Try out the Windows Explorer view of MSN. Click a folder, and then on the File menu, click Explore.
• Even if your MSN window is minimized, you can use this icon on the Windows 95 taskbar, right next to the clock.
Click it with your right mouse button, and you'll see a menu that includes E-mail, Find, MSN Central, Favorite Places, and Go To.

Fig.5: the software includes "Tips For New Users". You should learn to do as much as possible off line.

Fig.6: a view of the Microsoft Network, as seen by the Windows Explorer. This is accessed by clicking File, Explore.

remembering passwords), then click on "Connect".

You then connect for the first time (see Fig.2). A popup screen asks you if you want to load the Inbox; eg, if you have some mail. When I did this, I received a welcome message from Microsoft. One nice thing about the MSN software is that you can use the normal Windows commands to view or print these messages.

The main Microsoft Network screen (Microsoft Central) will also come up (see Fig.3). The options that I mainly use are "Categories" (for accessing the Newsgroups) and "Email". There is also a wealth of places to visit on "MSN Today". You only need to start clicking away to explore the Net but remember the $5.00 per hour fee – it's very addictive and you can soon run up a sizeable bill searching through all this interesting stuff.

Whenever you find a place you may want to visit again, it is an excellent idea to either make a shortcut or add it to your "Favorite Places". This will save all the keystrokes or mouse clicks next time you want to return to the same location. Also, to make searching easier, I always select the Toolbar, as this has a few buttons, such as "Up One Level" and "MSN Central", which make life a little easier. Remember though that this is costing you around $5.00 per hour, so you should go to Tips (see Fig.5) and learn to do as much as possible off line.

You can also select File, Explore, to get a view of the Net as seen by the Windows Explorer (see Fig.6)

Newsgroups

To access Newsgroups, click "Categories", then "The Internet Center" (see Fig.4). All you need to do now is click on the newsgroups you want to explore and browse to your heart's content.

Email

The Inbox is where your received mail is stored. You can also select "Compose", "New Message" to send mail to anyone in the world, provided they are on the Net. Just click on the "Send" icon when you have finished the message.

Other service providers

If you already have an existing Internet account which you want to use instead of, or as well as, an MSN account, and you had a 16-bit version of the software running Windows 3.11, it should run with no problems on Win 95. For example, I have Trumpet Winsock 2.1, Netscape 1.2B5 and Free Agent 1.0 (an excellent newsreader, available at http://www.forteinc.com/forte/agent/freagent.htm).

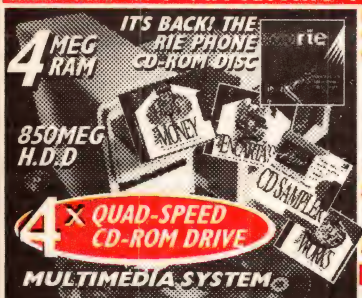
If you want to try using 32-bit software, there is an automated dialler available at http://WWW.NetEx.NET:80//w95/windows95/internet/. This improves on the abysmal "Dial Up Networking" that Microsoft provides, which does not even have an automatic redial facility (or, at least, it was so well hidden that I couldn't find it).

Finally, readers should note that all my tests were made with a late beta version of Win 95. The final offering may give slightly different results to the screen captures shown here. **SC**

ANNUAL CATALOGUE 1995-96 OUT NOW! CONTAINS THOUSANDS OF HARD-TO-FIND PRODUCTS! 100% AUSTRALIAN OWNED. LATEST PENTIUM PCI PRODUCTS ESTABLISHED SINCE 1977.

RITRON QUAD SYSTEMS

INCORPORATING THE QUAD-SPEED CD-ROM DRIVE , 4 MB RAM AND THE CPU PROCESSING POWER OF YOUR CHOICE.



Configuration: • Quad-Speed CD-ROM drive • 4 MEG RAM • 850 MEG Hard Disk Drive • 1 MEG Video Card • 14" SVGA N.I. Monitor-1024 x 768mm 0.28mm Dot Pitch • 1.44 3.5" F.D.D. • Ritron Mouse Pad • Mouse & Joystick • 101 High Quality Keyboard • 16-bit Sound Card • Magnetically Shielded Speakers • Windows 95 or DOS 6.22 & Windows 3.11 • ***INCLUDE 5 FREE CD SOFTWARE TITLES:*** MS Works/Ms Encarta 95/MS Money & MS Sampler and White & Yellow Pages Phone Disc • ***20 Mbytes FREE SHAREWARE GAMES.***

CPU CHOICES	TAX EX	TAX INC
DX2-66	$1629	$1879
DX2-80	$1689	$1949
DX4-100	$1710	$1989
Pentium™ 60	$1770	$2195
Pentium™ 75	$1979	$2249
Pentium™ 90	$2161	$2499
Pentium™ 100	$2259	$2599
Pentium™ 120	$2639	$2999

Windows® 95 available

FREE HOME DELIVERY & SETUP-MELBOURNE METRO AREA ONLY

4 YEAR PARTS & LABOUR WARRANTY
(FIRST 2 YEAR ON-SITE) MELB MET AREA ONLY
4 HOUR FREE TRAINING COURSE

Choosing the right system configuration has never been so easy -simply match your needs & budget to the choices here and you are well on the way to exploring the world of multimedia. Each & every system is powerful in its own rights and will handle today's complex & software applications quite easily.

RITRON QUAD SYSTEM PRO

INCORPORATING THE QUAD-SPEED CD-ROM DRIVE , 8 MB RAM AND THE CPU PROCESSING POWER OF YOUR CHOICE.

Configuration: • Quad-Speed CD-ROM drive • 8 MEG RAM • 1 GIG Hard Disk Drive • 1 MEG Video Card • 14" SVGA N.I. Monitor-1024 x 768mm 0.28mm Dot Pitch • 1.44 3.5" F.D.D. • Ritron Mouse Pad • Mouse & Joystick • 101 High Quality Keyboard • 16-bit Sound Card • Magnetically Shielded Speakers • Windows 95 or DOS 6.22 & Windows 3.11 • ***INCLUDE 5 FREE CD SOFTWARE TITLES:*** MS Works/Ms Encarta 95/MS Money & MS Sampler and White & Yellow Pages Phone Disc • ***20 Mbytes FREE SHAREWARE GAMES.***

CPU CHOICES	TAX EX	TAX INC
DX2-66	$1919	$2219
DX2-80	$1969	$2219
DX4-100	$1939	$2239
Pentium™ 60	$1999	$2279
Pentium™ 75	$2399	$2699
Pentium™ 90	$2499	$2799
Pentium™ 100	$2589	$2899
Pentium™ 120	$2999	$3399
Pentium™ 133	$3499	$3999

Windows® 95 available

FREE HOME DELIVERY & SETUP-MELBOURNE METRO AREA ONLY

4 YEAR PARTS & LABOUR WARRANTY
(FIRST 2 YEAR ON-SITE) MELB MET AREA ONLY
4 HOUR FREE TRAINING COURSE

This range of systems offer higher perfomance levels with 8 Meg of RAM, a huge 1 GIG hard disk drive and the Quad-Speed CD-ROM drive. Video or animation files will play more smoothly than ever before, off this CD-ROM drive. Internet connection is child's play with these powerful systems.

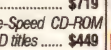
NEW PRODUCTS SHOWCASE

CREATIVE SB MULTIMEDIA PACKS

Choose from this wide range of Double-Speed or Quad-Speed CD-ROM Drive multimedia packs, with great software inlcuded...

- **SB DISCOVERY 210 KIT** *with Double-Speed CD-ROM Drive, SBS30 Stereo Speakers, 12 CD titles* $329
- **SB DISCOVERY 420 KIT** *with Quad-Speed CD-ROM Drive, SBS30 Stereo Speakers, 12 CD titles* $559
- **SB DISCOVERY 440 KIT** *with Quad-Speed CD-ROM Drive, Stereo Speakers, 22 CD titles* $719
- **SB HOMEDIA 210 KIT** *with Double-Speed CD-ROM Drive, SBS30 Stereo Speakers, 15 CD titles* $449

EPSON PRINTERS



- **LX300** *264 Cps Draft, 9 pin dot matrix* $249
  - ***With colour option*** *$349*
- **LQ300** *216 Cps Draft, 24 pin dot matrix* $429
  - ***With colour option*** *$529*
- **Stylus Pro** *720dpi full colour A4* ***NEW!*** $1399
- **Stylus Pro XL** *720dpi full colour A3* ***NEW!*** $2899
- **EPL 3000** *300dpi, 4ppm, laser printer* $859
- **EPL 5200+** *300dpi, 6ppm, laser printer* $1299
- **EPL 5600** *600dpi, 6ppm, laser printer, RISC* $1599
- **EPL 9000** *600dpi, 8ppm, laser, A3* ***NEW!*** $3499

ALL NEW INKJET PRINTERS:

- **Stylus Colour 820*** *720x360dpi b/w A4* ***NEW!*** $509
- **Stylus Colour IIs** *720dpi full colour A4* ***NEW!*** $859
- **Stylus Colour II** *720dpi full colour A4* ***NEW!*** .. $799
- **Colour capable with optional upgrade kit* *$219*

NEW MOTHERBOARDS

OPTI895 GREEN PC
Mainboard $199
With CYRIX DX2-66
CPU installed $279
With 4 x 72 pin SIMM sockets 256K REAL CACHE

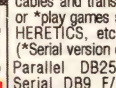
80486 GREEN
Mainboard $149
With CYRIX DX2-66
CPU installed $229
0K FUNCTIONAL L2 CACHE
With 2 x 72 pin & 4 x 30 pin SIMM sockets

LAPLINK CABLES

Connect two computer with these cables and transfer files quickly or *play games such as DOOM, HERETICS, etc, interactively! (*Serial version only)

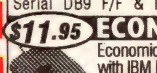
Parallel DB25 M/M 2 Metre.....**$12.50**
Serial DB9 F/F & DB25 25 pin...**$14.50**

$11.95 ECONOMY MOUSE



Economical mouse • Compatible with IBM PC, XT, AT/386/486, PS2 • Opto-Mechanical encoder • Dynamic resolution and fast tracking speed

101 KEYBOARD *UPDATE NOW!*



With 2 year warranty.

1-9	10+
$22.95	$21.95

RITRON COMPUTER SYSTEMS

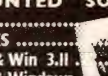
NEW LOWER PRICES NOW WITH 540 MB H.D.D.

CPU TYPE	GREAT VALUE!!	TAX EX.	TAX INC
486DX2-66		$1069	$1299
486DX2-80		$1099	$1339
486DX4-100		$1149	$1399
Pentium™ 60		$1350	$1639
Pentium™ 75		$1495	$1949
Pentium™ 90		$1595	$1945
Pentium™ 100*		$1650	$1999
Pentium™ 120		$2175	$2653
Pentium™ 133		$2775	$3385

*External 256K Cache

4 YEAR PARTS & LABOUR WARRANTY
All systems include: 4 MEG RAM • 540 MEG H.D.D. • *GREAT VALUE!!* • 1.44 MEG 3.5" FDD • Mini or Baby AT casing • 2 SPG Ports • 101 Keyboard • 3 Slots VESA Local Bus Motherboard • 14" SUPEaR VGA (1024 X 768) (0.28" DOT PITCH) Colour Monitor • VLB IMB VGA Cards are supplied in 486 machines AT NO EXTRA COST (Up to 1280 x 1024) *Pentium systems now come with PCI Cards and should be bought with 8MB of RAM* INCLUDING MULTIMEDIA SYSTEMS

DISCOUNTED SOFTWARE



DOS 6.22	*$89
M.S WORKS	*$99
DOS 6.22 & Win 3.11	*$139
DOS 6.22 & Windows for Workgroups	*$159
MS Office Pro	*$795
Windows® 95 OEM CD	$159
Windows® 95 OEM 3.5"	$159

*When purchased with a system only.

XSTREAMA FAX MODEM $169

14.4 bps internal card fax modem V.32bis/32/22bis/22 Industry standard. Package contains: • Modem unit • Telephone Cable • Operation Manual • Power Adaptor • Data Communication Software • Fax Application Software • Free 5 Hour Internet Access.

NEW

FREE 3 HOUR TRAINING COURSE (MELB. ONLY)

FOR ALL COMPUTER SYSTEMS INCLUDING MULTIMEDIA SYSTEMS

UPGRADES & PERIPHERALS FOR YOUR SYSTEMS

HARD DRIVES *VOICE COIL IDE HD*

Capacity	Av.Access	Tax Inc.	Tax Ex.
212M	16ms	$267	$220
260M	16ms	$242	$200
420M	12ms	$269	$222
540M	12ms	$292	$240
640M	12ms	$364	$299
850M	11ms	$365	$299
1.08GB	12ms	$439	$359
1.27GB WESTERN DIGITAL	10ms	$549	$450
1 GB SCSI HD	10ms	$780	$650
2.15GB SCSI HD	10ms	$1815	$1500

ALL DRIVES COME WITH 3 YEAR WARRANTY

HARD DRIVE BRACKET.... $4.95

SUPA MOTHERBOARD UPGRADES

- **486DX2-66#** L.B No Cache $229
- **486DX2-66#**256K Cache L.B $279
- **486DX2-80#**256K Cache L.B ***NEW!*** $299
- **PENTIUM™ 60MHz/256 C VESA/PCI** $399
- **PENTIUM™ 75MHz®/256 C PCI/ISA** ***NEW!*** $695
- **PENTIUM™ 90MHz® PCI/ISA** $799
- **PENTIUM™ 100MHz® PCI/ISA** $899
- **PENTIUM™ 120MHz® PCI/ISA** $1599

**AMD CPU, #CYRIX CPU Without Asterisk- INTEL CPU @ Come with I/O Card fitted on motherboard*

MEMORY

	1-9	25+	100+
30 PIN SIMM			
1M x 9-70 With Parity	$69	$68	$65
4M x 8-70 No Parity	$239	$228	$224
4M x 9-70 With Parity	$249	$245	$239
72 PIN SIMM FOR PENTIUM™ Processor M.B.			
4M X 8-70 No Parity	$249	$229	$209
4M X 9-70 With Parity	$259	$249	$239
8M X 9-70 No Parity	$469	$419	$399
16M X 8-70 No Parity	$849	$829	$749
16M X 9-70 With Parity	$899	$879	

INK JET CARTRIDGE REFILLS

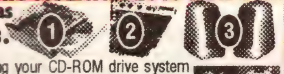
TJC-202 SUITABLE FOR CANON BC-01, CANON BC-02

TJH-626 SUITABLE FOR HEWLETT PACKARD DESKJET SERIES

ONLY $8.95

COMPRO MULTIMEDIA UPGRADE KIT

Easy as 1,2,3.



Upgrading your CD-ROM drive system has never been so easy. Simply follow the installation instructions on the box. Both the Double & Quad Speed CD-ROM drive are Kodak PhotoCD® compatible. Includes the same 16-bit Sound Card, Stereo Speakers and great Software titles: Microsoft- Encarta'95/Works/Money/ Golf/Dangerous Creatures & Scenes.

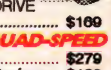
Dual-Speed Version $329
Quad-Speed Version $449

NEW

FLOPPY DISK DRIVES

1.44 F.D.D $55.00
1.2MB F.D.D. $89.00

CD ROM DRIVES



DUAL-SPEED CD ROM DRIVE
IDE INTERFACE $169
NEW PANASONIC IDE Interface ***QUAD-SPEED*** CD ROM DRIVE $279
PANASONIC 526J Panasonic Interface .. $169

BULK DISK PRICES

PRICES ARE PER BOX OF TEN DISKS

All disks come with Write Protects and envelopes and a life time warranty.

DESCRIPTION	1-9	10+	50+	100+	500+
5¼ DS/DD	$4.50	$4.50	$4.50	$4.30	$3.95
5¼ DS/HD	$6.85	$6.75	$6.50	$6.30	$5.90
3½ DS/DD	$5.95	$5.75	$5.50	$5.25	$5.00
3½ DS/HD	$5.50	$5.10	$4.90	$4.80	$4.70

XSTREAMA MODEMS...

28.8BPS EXTERNAL FAX MODEM $399

- 28.8 bps V.32bis high speed desktop Fax Modem • Support Group 3 send/ receive fax EIA/TIA Class 1 and 2 command set.

NEW

14.4BPS EXTERNAL FAX MODEM $219

- 14.4 bps high speed desktop Fax Modem • V.32bis/32/22bis/22 Industry standard • Support Group 3 send/receive fax EIA/TIA 2 command set. ***Same casing as 28.8bps.***

Both pack contain: • Modem unit • Telephone Cable • Operation Manual • Power Adaptor • Data Communication Software • Fax Application Software • ***Free 5 Hour Internet Access.***

COMPUTER CASES

- MINI TOWER CASE $85
- MIDI TOWER CASE $105
- FULL TOWER CASE $119

NEW

All cases come with 200watt power supplies

HONEYWELL MOUSE

No Ball mouse!

$69.95

This unique mouse uses a special tracking technology that allow it to be used on any surface horizontally or vertically. Maintenance-free. Ideal mouse for dusty workshop or school.

NEW

No balls! Unique tracking mechanism

Unique X-Y sensors

Windows® 95

- Upgrade ACAD 3-H *$95*
- Upgrade 3-H *$135*
- Upgrade CD *$135*
- Base 3-H *$269*
- Base ACAD 3-H *$179*

RIE'S 1995-96 ANNUAL CATALOGUE AVAILABLE NOW!!

196 PAGES

ONLY $1.00

Packed with over 10,000 line items of old favourites and new products. Limited stock! So get your copy before they all run out!

rie ROD IRVING ELECTRONICS PTY. LTD.

FOR THE SERIOUS COMPUTER USERS A.C.N. 005 428 437

FREE CATALOGUE ERRORS & OMISSIONS EXCEPTED. PRICES/CHANGE WITHOUT NOTICE.

HEAD OFFICE: 56 Renver Rd Clayton, Victoria, 3168 Ph: (03) 9543 7877

MELB: 48 A'Beckett St. City.	Ph:(03) 9663 6151.	Fax (03) 9639 1641 Computers: (03) 9639 1640
VERMONT: 190 Rooks Rd.	Ph: (03) 9874 8888.	Fax:(03) 9874 2288
OAKLEIGH: 240C Huntingdale Rd.	Ph: (03) 9562 8939.	Fax:(03) 9562 8940
NORTHCOTE: 423 High St.	Ph: (03) 9489 8866.	Fax:(03) 9489 8131
BOX HILL: 1031 Maroondah Hwy.	Ph: (03) 9899 6033.	Fax:(03) 9899 0156
ADELAIDE: 241-243 Wright St.	Ph. (08) 211 7200.	Fax:(08) 211 7273
SYDNEY: 74 Parramatta Rd, Stanmore.	Ph: (02) 519 3888.	Fax:(02) 516 5024

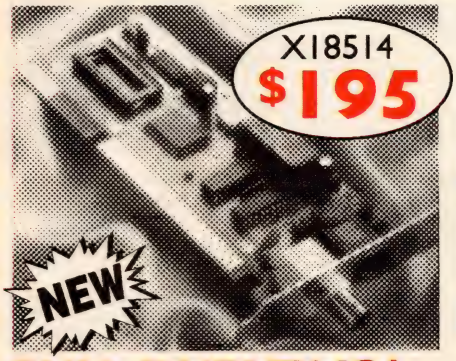
BLUESTAR COMPUTERS: 271 Maroondah Hwy. Ringwood Ph: (03) 9870 1800
Fax:(03) 9879 3027 TRADING HOURS: Mon/Fri 9am - 5.30pm.Sat 9am - 1pm

City store open till 8pm on Fridays. Box Hill store open till 3pm on Saturdays.

Tax Exempt sales: RITRONICS WHOLESALE Ph. (03) 9543 2166 Fax. (03) 9543 2648
RIE BULLETIN BOARD Ph: (03) 9562 7877 For Specials, info & Shareware
E-MAIL: rie@ozemail.com.au
MAIL ORDER: Ph:(03) 9543 7877 Fax:(03) 9543 8295
Mail Order Hotline 1-800 33 5757

Pentium™, OverDrive™ & Intel486™ are registered trademarks of the Intel Corporation SCGG0C196

ALL NEW ETHERNET CARDS -ISA & PCI



FULL-DUPLEX ISA ETHERNET CARD

Microsoft Windows 95 Plug and Play
This Ethernet card is a 16-bit software configuration ISA Ethernet adaptor, features the newest Plug and Play function (PnP). It simply plugs to an PnP ISA bus slot and requires no configuration from the user that relieve the users from the pain of taking care of the adaptor resource configuration.

Easy Installation
Optionally, a friendly and powerful setup program is also available to set up this card with applications that are not Plug & Play compatible.

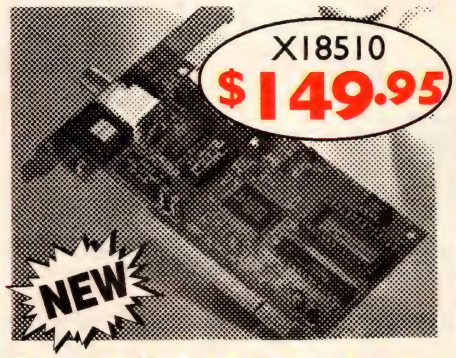
Software Compatibility
Drivers support include Novell Netware 3.x. 4.x, Microsoft LAN Manager, Windows for Workgroups, Windows NT, Banyan, Packet driver, Lantastic and Windows 95

Full-Duplex/Half-Duplex in option
Supports "Full-Duplex and Half-Duplex" in option. The adaptor's Full-Duplex technology enables traffic flow in both directions simultaneously on twist-pair link and doubles cabling bandwidth from 10 to 20 Mbps when used with switching HUB.

Technical Features/Specifications
- 16-bit ISA BUS Ethernet adaptor
- Complies with Ethernet II and IEEE 802.3 10Base-2, 10Base-T standard
- Compatible with Novell's NE2000 adaptors

Support the following:
- *FULL-DUPLEX ETHERNET FUNCTION TO DOUBLE CHANNEL BANDWIDTH*
- *RJ-45 AND BNC INTERFACE, AUTO-DETECTION*
- *MICROSOFT'S PLUG AND PLAY AUTO-CONFIGURATION*
- *16KB, 32KB AND 64KB BOOT ROM SIZE*
- *16KB LOCAL BUFFER MEMORY*
- *AUTO-DETECTION FOR BNC OR UTP CABLING INTERFACE*
- *AUTO-DIAGNOSTIC AND LOOPBACK TESTING SOFTWARE*
- Additional jumper for setting Thin Ethernet cabling length in optional 300M or 185M
- Additional jumper for setting on-board terminator for BNC cabling
- Two LEDs for indicating UTP port's signal polarity detection and correction

AVAILABLE VIA MAIL ORDER



FULL-DUPLEX PCI ETHERNET CARD

Easy Installation
This card supports BIOS level auto-configuration. It simply plugs to a PCI extension bus slot and requires no configuration from the user.

High Performance
It is a 32-bit PCI Local Bus high performance Ethernet card which supports 486 and Pentium system with speed of up to 33Mhz.

Software Compatibility
Supports 32-bit device driver and is completely compatible with Novell NE2000 driver for the highest performance possible. It offers various turbo drivers to boost up performance, including Novell Netware 3.x, 4.x, Microsoft LAN Manager, Windows for Workgroups, Windows NT, LANMAN, Banyan and Windows 95.

Full-Duplex/Half-Duplex in option
Supports the newest Ethernet technology, Full-Duplex and Half-Duplex in option. The card's Full-Duplex technology enables traffic flow in both direction simultaneously on twist-pair link and doubles cabling bandwidth from 10 to 20 Mbps when used with switching HUB.

Technical Features/Specifications
- 32-bit PCI Local Bus Ethernet adaptor
- Complies with Ethernet II and IEEE 802.3 10Base-2, 10Base-T standard
- Compatible with 32-bit driver and Novell's NE2000 driver

Support the following:
- *FULL-DUPLEX ETHERNET FUNCTION TO DOUBLE CHANNEL BANDWIDTH*
- *RJ-45 AND BNC INTERFACE, AUTO-DETECTION*
- *BIOS LEVEL PLUG AND PLUG AUTO-CONFIGURATION*
- *BOOT ROM FUNCTION FOR PCI BUS, ROM SIZE: 8K, 16K AND 32K*
- *16KB LOCAL BUFFER MEMORY*
- *SIGNAL POLARITY DETECTION AND CORRECTION FOR UTP PORT*
- *AUTO-DIAGNOSTIC AND LOOPBACK TESTING SOFTWARE*
- Additional jumper for setting Thin Ethernet cabling length in optional 300M or 185M
- Additional jumper for setting on-board terminator for BNC cabling
- Two LEDs for indicating UTP port's signal polarity detection and correction

AVAILABLE VIA MAIL ORDER OR BY ORDER FROM OUR STORES.

ETHERNET CABLES

Solve your networking problems with our varied length ethernet cables. Save heaps!

- **BNC 50 OHM 2M NETWORKING CABLE M-M** P37702 ..... **$7.95**
- **BNC 50 OHM 3M NETWORKING CABLE M-M** P37703 ..... **$9.50**
- **BNC 50 OHM 5M NETWORKING CABLE M-M** P37705 ..... **$10.95**
- **BNC 50 OHM 10M NETWORKING CABLE M-M** P37710 ..... **$16.95**
- **BNC 50 OHM 15M NETWORKING CABLE M-M** P37715 ..... **$22.95**
- **BNC 50 OHM 20M NETWORKING CABLE M-M** P37720 ..... **$29.95**
- **BNC 50 OHM 30M NETWORKING CABLE M-M** P37730 ..... **$39.95**
- **BNC 50 OHM 40M NETWORKING CABLE M-M** P37740 ..... **$49.95**

BNC SOCKETS

"F" SHAPE ADAPTOR PLUG TO TWO SOCKETS

	1-9	10+
P10604	$9.95	$8.95

"Y" SHAPE ADAPTOR PLUG TO TWO SOCKETS

	1-9	10+
P10606	$9.95	$8.95

BNC CONNECTORS

BNC SOLDERLESS TWIST ON PLUG

	1-9	10+
P10531	$3.95	$3.75

BNC CONNECTORS

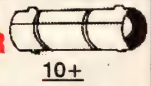
DOUBLE BNC FEMALE

	1-9	10+
P10501	$4.25	$3.50

BNC "T" ADAPTOR 2 Female to Male

	1-9	10+
P10505	$5.25	$4.50

BNC JOINER



	1-9	10+
P10513	$3.50	$2.95

BNC RIGHT ANGLE PCB MOUNTING

	1-9	10+
P10545	$4.95	$3.95

BNC CRIMP RG58 50 OHM MALE

	1-9	10+
P10523	$2.50	$2.25

UTP (LEVEL 5) PATCH CABLE

Connecting to 10 BASE "T" and RJ45 devices (RJ45M-RJ45M)

- **RJ45M -RJ45M 0.5M Patch Cable** P37760 ..... **$8.95**
- **RJ45M - RJ45M 1M Patch Cable** P37762 ..... **$9.95**
- **RJ45M - RJ45M 2M Patch Cable** P37764 ..... **$10.95**
- **RJ45M - RJ45M 3M Patch Cable** P37766 ..... **$11.95**
- **RJ45M - RJ45M 5M Patch Cable** P37768 ..... **$16.95**
- **RJ45M - RJ45M 10M Patch Cable** P37769 ..... **$29.95**
- **RJ45M - RJ45M 15M Patch Cable** P37767 ..... **$36.95**
- **RJ45M - RJ45M 20M Patch Cable** P37720 ..... **$44.95**

FOR HOST ADAPTERS

ERRORS & OMISSIONS EXCEPTED. PRICES CHANGE WITHOUT NOTICE.

ROD IRVING ELECTRONICS PTY. LTD.

YOUR FIRST CHOICE IN QUALITY ELECTRONICS A.C.N. 005 428 437 ESTABLISHED SINCE 1977

NEW KITS NEW KITS NEW KITS NEW KITS

LED BATTERY VOLTAGE INDICATOR

Here's a flexible circuit that can be used in just about any piece of battery operated equipment, to combine the functions of a power-on LED and battery voltage indicator. Measuring only 25mm square, the circuit can be easily mounted in the smallest of spaces, to give you warning of impending battery failure.

EA SEPT'95

K10690 **$9.95**

JACOB'S LADDER DISPLAY

NEW

Ever since scientific showmen like Tesla and Edison were able to generate really high voltages, the Jacob's Ladder display has been creating awe amongst laymen.

SC SEPT'95

Without COIL K10695 **$29.95**

With COIL K10696 **$59.95**

IMPROVED FLEXITIMER MK2

This simple but extremely flexible circuit can be used for just about any semi-fixed timing applications, with its ability to select timing periods from seconds to days. It has four separate outputs, two independant and programmable timing "events", can be sychronised awith the 50Hz mains or driven by an internal RC clock, and can be powered from either an AC or DC source.

EA **AUG'95**

K10685 **$22.95**

LOW COST TRANSISTER & MOSFET TESTER

NEW

This handy tester is designed to plug into a digital multimeter to provide accurate measurement of transistor beta, to values up to 50,000 or more. You can use it to test small signal, power & Darlingtons transistors &, as a bonus, it will check Mosfets.

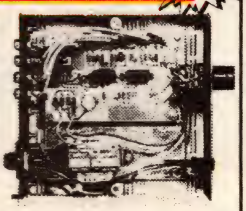
SC ***May '95***

K10675 **$29.95**

ECONOMY SURROUND SOUND DECODER

NEW

Perhaps your budget can't quite stretch to the cost of a full "bells and whistles" Dolby Pro-Logic surround sound decoder. Or alternatively, you might be one of those music lovers who doesn't like the idea of subjecting your favourite music to a lot of fancy digital processing. Either way, this really low cost Halfer-type analog decoder should appeal to you.



EA ***May '95*** K10670 **$59.95**

PC- DRIVEN ELECTROCARDIOGRAM

This simple project will let you take your own electrocardiograph, and display it on a PC. With the software supplied, you can read, display, save to disk and print the electrical waveform generated by your own heart (or anyone else's). Powered by a 9V battery and electrically isolated from the computer, the PC-ECG is a safe, low cost way to monitor the electrical activity of the heart

EA ***JULY '95***

K10680 **$29.95**

A PHOTOGRAPHIC TIMER FOR DARKROOMS

If you are looking for an accurate way to control film developing times, then take a look at this Photographic Timer. It will switch on mains-powered fluorescent ultraviolet tubes or incandescent lamps rated at up to 1200W for a preset time ranging from 1 - 450 seconds.

Silicon Chip April '95

K10665 **$64.95**

DIGITAL TRIGGER ADAPTOR FOR SCOPES

K10660 **$68.95**

With eight inputs (expandable to 24), this useful device will monitor almost any digital circuit and trigger your oscilloscope only when a preset combination of inputs is found. It also includes an adjustable triggering delay, so it can effectively convert your scope into a low cost logic analyser. EA ***April '95***

KITS KITS KITS KITS KITS KITS KITS

CAT	Description	R.R.P
K10005	SOLAR VOLTAGE REGULATOR	$13.95
K10040	ETI 480 50W AMP	$27.95
K10045	ETI 480 100W AMP	$34.95
K10050	ETI 480 POWER SUPPLY	$28.95
K10060	BALANCED MICROPHONE AMPLIFIER	$12.95
K10065	GENERAL PURPOSE AMPLIFIER	$14.95
K10070	BALANCED INPUT DIFFERENTIAL PREAMP	$19.95
K10075	FLOAT NICAD CHARGER	$14.95
K10080	TRANSISTOR TESTER	$22.95
K10085	300W PLAYMASTER AMP	$119.00
K10095	2 TONE ALARM	$9.95
K10100	1.5V TO 9V DC CONVERTER	$11.95
K10105	3 DIGIT COUNTER	$22.95
K10110	ELECTRIC FENCE	$23.95
K10115	ELECTRIC FENCE CONTROLLER	$61.95
K10120	TV PATTERN GENERATOR	$94.95
K10125	UNIVERSAL POWER SUPPLY	$12.95
K10135	LED SCANNER	$17.95
K10140	LOW FUEL INDICATOR FOR CAR	$11.95
K10145	SCREECHER CAR ALARM	$36.95
K10150	12/24V LIGHT CHASER	$21.95
K10160	THERMOSTATIC SWITCH FOR RADIATOR FANS	$31.95
K10165	I/O ADAPTOR FOR PC's	$59.95
K10170	INPUT BUFFER & RELAY DRIVER	$34.95
K10175	LOW COST SIG. TRACER/AMP	$69.95
K10180	STEREO FM TRANSMITTER	$33.95
K10155	LOW VOLTAGE CUTOUT FOR CAR /BOAT	$22.95
K10200	IN-CIRCUIT TRANSISTOR TESTER	$14.95
K10205	VHF POWERMATCH	$74.95
K10215	TEMPERATURE PROBE FOR MULTIMETERS	$19.95
K10225	18V / 1AMP BENCH TOP POWER SUPPLY	$79.95
K10260	INVERTER 2KW (NON ASSEMBLED)	$1,495.00
K10265	INVERTER 2KW ASSEMBLED & TESTED	$1,895.00
K10295	LOW OHMS METER	$29.95
K10300	TEMPERATURE ADAPTOR	$24.95
K10305	VOICE OPERATED RELAY	$19.95
K10310	IGNITION KILLER	$22.95
K10315	HEADPHONE AMPLIFIER	$34.95
K10320	VIDEO RF MODULATOR	$17.95
K10325	50W AUDIO AMPLIFIER	$54.95
E10325	PCB 50W AUDIO AMPLIFIER TDA1514A	$19.95
K10330	RS232 FOR COMMODORE 64	$24.95
K10335	RGB TO PAL ENCODER MODULE	$49.95
K10340	CAMCORDER MIXER	$29.95
K10345	KARAOKE BOX	$28.95
K10350	REMOTE CONTROL EXTENDER FOR VCRS	$32.95
K10355	HIGH ENERGY IGNITION	$49.95
K10356	BREAKERLESS IGNITION	$44.95
K10360	LOUDSPEAKER PROTECTOR	$29.95
K10370	PORT. 12V LEAD ACID BATTERY CHARGER	$27.95
K10375	15W 12-240V INVERTER	$49.95
K10380	1GHz DIGITAL FREQUENCY COUNTER	$147.95
K10390	LOW COST QUIZ GAME ADJUDICATOR	$34.95
K10395	16-SECOND MESSAGE RECORDER	$65.95
K10400	WOOFER STOPPER	$55.95
K10405	COLOUR VIDEO FADER	$32.95
K10415	PC-CONTROLLED EPROM PROGRAMMER	$99.95
K10425	DELUXE CAR ALARM	$55.95
K10430	REMOTE CONTROL ELECT. COCKROACH	$69.95
K10440	HIGH EFFICIENCY FLUORO INVERTER KIT	$49.95
K10445	IMPROVED DECODER FOR ACS SIGNALS	$19.95
K10450	A SIMPLE LOW VOLTAGE SPEED CONTROLLER	$13.95
K10455	PRINTER STATUS INDICATOR FOR PRINTERS	$65.95
K10465	LOW COST 25W AMPLIFIER MODULE	$18.95
K10460	VERSATILE 40V / 3A LAB POWER SUPPLY	$165.95
K10470	CHAMP 0.5 WATT AMPLIFIER	$9.95
K10475	90 SECOND MESSAGE HOLDER	$97.95
K10476	75 SECOND MESSAGE HOLDER	$93.95
K10480	CONTROL STEPPER MOTORS WITH YOUR PC	$65.95
K10485	EGO TESTER KIT	$19.95
K10490	LOW COST MIDI BREAK-OUT BOX	$32.95
K10495	200W INVERTER KIT	$199.95
K10500	VOICE OPERATED AUDIO SWITCH	$12.95
K10505	SIMPLE LED CHASER	$19.95
K10510	LEVEL CROSSING DETECTOR FOR MODEL RAILWAYS	$29.95
K10515	SOUNDS & LIGHTS FOR LEVEL CROSSING	$34.95
K10520	AN IMPROVED DSO ADAPTOR FOR PC'S	$158.95
K10521	DSO ADAPTOR (INCLUDES ADC0861)	$168.95
K10525	WEEKLY REMINDER TIMER	$19.95
K10530	L/NOISE UNI. STEREO PREAMP	$19.95
K10535	LIGHT & SOUND TRIGGER	$41.95
K10540	50W AUDIO AMPLIFIER	$37.50
K10545	IND. METAL BALANCE DETECTOR	$58.95
K10550	FAST CHARGER FOR NICAD	$42.95
K10555	DUAL ELECTRONIC DICE	$24.95
K10560	DIGITAL VOLTMETER FOR CARS	$39.95
K10565	DIGITAL TACHOMETER FOR CARS	$49.95
K10570	COOLANT LEVEL ALARM	$29.95
K10575	STEAM TRAIN WHISTLE & DIESEL HORN SIMULATOR	$22.45
K10580	BUDGET PRICED TEMPERATURE CONTROL	$39.95
K10585	HIGH-POWER DIMMER FOR INCANDESCENT LAMPS	$69.95
K10595	NICAD ZAPPER	$29.95
K10600	GO/NO-GO CRYSTAL CHECKER	$18.95
K10605	CHAMP PRE-AMP	$8.95
K10610	MINIVOX VOICE OPERATED RELAY	$13.95
K10615	LONG-WAVE AM RECEIVER FOR AIRCRAFT WEATHER INFORMATION	$37.50
K10620	AUTO DISCHARGER FOR NICAD BATTERY PACKS	$27.95
K10630	TALKING HEADLIGHTS REMINDER	$62.95
K10635	BEGINNER'S VARIABLE DUAL-RAIL POWER SUPPLY	$39.95
K10640	CLIFFORD-A PESKY LITTLE ELECTRONIC CRICKET	$15.45
K10645	3-SPOT LOW DISTORTION SINEWAVE OSCILLATOR	$49.95
K10650	A BUDGET PRICED "SHOESTRING" STEREO AMP	$99.95
K10655	DIGITAL EFFECTS UNIT FOR MUSICIANS	$138.95
K10660	DIGITAL TRIGGER ADAPTOR FOR SCOPES	$68.95
K10665	A PHOTOGRAPHIC TIMER FOR DARKROOMS	$64.95
K10670	ECONOMY SURROUND SOUND DECODER	$59.95
K10675*	LOW COST TRANSISTOR TESTER/MOSFET	$29.95
K10680*	PC- DRIVEN ELECTROCARDIOGRAM	$29.95
K10685*	IMPROVED FLEXITIMER MK2	$22.95
K10690*	LED BATTERY VOLTAGE INDICATOR	$9.95
K10695*	JACOB'S LADDER DISPLAY (Without Coil)	$29.95
K10696*	JACOB'S LADDER DISPLAY (With Coil)	$59.95

*SOON AVAILABLE

SCKITOCT-SEPT96S

PLEASE SEND ALL MAIL ORDERS TO:
MAIL ORDER DEPT, ROD IRVING ELECTRONICS PTY. LTD.,
LOCKED BAG 620, ROSEBANK MDC,
CLAYTON SOUTH, VIC 3169.

ROD'S HOTLINE 1-800 33 5757

MAIL-ORDER LOCAL CALLS: (03) 9543 7877

ERRORS & OMISSIONS EXCEPTED. PRICING CHANGE WITHOUT NOTICE

ROD IRVING ELECTRONICS PTY. LTD.
YOUR FIRST CHOICE IN QUALITY ELECTRONICS A.C.N. 005 428 437
ESTABLISHED SINCE 1977
ROD'S HOTLINE 1-800 33 5757
MAIL ORDER LOCAL CALLS (03) 9543 7877

RIE- FOR GREAT VALUE PACKS!!

CAN YOU RESIST THESE BUNCH OF SPECIAL RESISTORS PACKS? ALL AT IRRESISTIBLE PRICING (EXCUSING THE PUN)!

RESISTOR PACK 1/4W MET.FILM PK250
R19001 $7.95

MIXED 5MM LED
PK100 $14.95 Z10136

RESISTOR PACK 1/4W CARBON
R19010 $6.95 PK250

DIODE 1N4004
Z10106 $5.95 PK100

BC 549 TRANSISTORS
T90806 $9.95 PK100

50V-100V CERAMIC CAPACITORS
R19020 $6.95

BC 548 TRANSISTORS PK100
T90804 $9.95

T90802 $9.95
BC 547 TRANSISTORS PK100

MIXED POLYESTER PK100 Capacitors
R15120 $12.95

LED RED 5MM
Z10138 $11.95 PK100

MIXED SEMI'S
Z10000 $9.95 PK100

3AG FUSES
S15992 $8.95 PK50

BC 549 TRANSISTORS
PK100 T90806 $9.95

BC 558 TRANSISTORS
T90808 PK100 $9.95

MIXED TRANSISTORS
T90800 $13.95

BC 547 TRANSISTORS
T90802 $9.95 PK100

DIODE 1N5404
Z10114 $9.95 PK100

GRAB BAG
Assorted Kit parts. Each other bag contains different items. So try your pot luck!
$9.95 R19050

MIXED POLYESTER Capacitors
$6.95 R19030 PK50

MIXED IC SOCKETS
P10546 $24.95 PK100

FUSE-M205
S15994 $8.95
Mixed M205 fuses. Contents may vary from pack to pack. PK50

MIXED FAST ACTION FUSES
S15995 $1.95 PK10

1N4148/1N914
Z10135 $3.95 PK100

CR-P2 6V PHOTO LITHIUM BATTERY
• 6V Lithium battery for photo and electronic devices • Dimension: 36 x 19.5 x 35mm. *Don't pay over $30 at a chemist or photo shop!*
S15160 $24.95 NEW

2CR5 6V PHOTO LITHIUM BATTERY
• 6V Lithium battery for photo and electronic devices • Dimension: 34x 17 x 45mm. *Don't pay over $30 at a chemist or photo shop!*
S15162 $24.95 NEW

CR123A 3V LITHIUM BATTERY
• 3V Lithium battery for photo and electronic devices • Dimension: 16.9 x 34.5mm. *Don't pay over $16.95 at a chemist or photo shop!*
S15164 $12.95 NEW

INCANDESCENT EASY LIGHTS
Battery operated (3 x AA batteries - not supplied). An ideal light for all those dark corners, shelves and cupboards. Can be hung or placed on tables/shelves etc.
A15093 $7.95 NEW

6W FLUORESCENT SHED LIGHT
Battery operated (4 x D batteries - not supplied) ideal light for all storage areas, sheds, basements, garage, boats, attics, etc. No wiring required. Goes anywhere
A15094 $28.95 NEW

75Ω TWO WAY SPLITTER $3.95
Splits UHF/VHF/FM signals.
• Input 1 x 75Ω plug
• Output 1 x 75Ω sockets
• Colour white
L11026 NEW

75Ω TWO WAY SPLITTER $3.95
Splits UHF/VHF/FM signals.
• Input 1 x 75Ω sockets
• Output 1 x 75Ω sockets
• Colour white
L11027 NEW

GREAT EXECUTIVE STRESS RELIEF DEVICE."YES YOU CAN ACTUALLY BLOW OFF STEAM" WITH THIS!
BACK IN STOCK! $129

STEAM ENGINE
YES! STEAM ("DONKEY") ENGINE- CAT No. A95000 Every child should have one of these. Great for mom and dad to play with as well.
• Easy to operate • Runs on Methylated Spirits • Steam engine produces sufficient horsepower to run other mechanical toy apparatus • Easy To maintain, simply oil the appropiate parts • Operating instructions included

HIGH SPEED SERIAL UARTS 16550 ICs

1-9	10+
$14.90	$13.95

ERRORS & OMISSIONS EXCEPTED. PRICES CHANGE WITHOUT NOTICE.

ALL NEW INKJET PRINTERS FROM EPSON

EPSON STYLUS COLOUR II

720 X 720DPI SPECIAL COATED PAPER & GLOSSY PAPER.
360 X 360DPI ON PLAIN PAPER.

$799 TAX INC.

C92310 $656 TAX EX.

This is a 64-nozzles (black), 3 x 20 nozzles (Magenta, Cyan, Yellow), colour inkjet printer •Multi-layer Actuator print head technology •Print speed: 400cps/LQ 20 cpi•Maximum resolution: 720 x 720 dpi•4 scalable fonts•5 bitmap LQ fonts•Friction feed with paper feeder•EPSON ESC/P2. IBM X24/X24E•Paper sizes: A4, Letter, B5, Legal, Statement, Executive, Envelopes (DL No.10) Index card (A6)•Accepts plain, special coated or glossy paper, and transparency film•Centronic® type 8-bit parallel interface/Macintosh® serial interface•Exclusive black & colour ink cartridge•433W x 248D x 198H mm

EPSON Stylus Black Ink Cartridge C92320.....$39.95
EPSON Stylus Colour Ink Cartridge C92330.....$59.95

EPSON STYLUS COLOUR IIs

720 X 360DPI ON SPECIAL COATED PAPER & GLOSSY PAPER.
360 X 360DPI ON PLAIN PAPER.

$659 TAX INC.

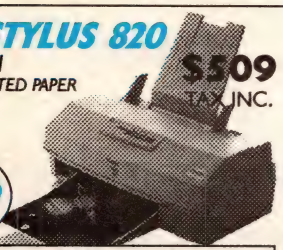
C92300 $542 TAX EX.

This is a 64-nozzle colour/black inkjet printer. It uses a black or colour ink cartridge •Multi-layer Actuator print head technology •Print speed: 250 cps/LQ 20 cpi in black, 340cps in colour mode•Maximum resolution: 720 x 360 dpi•4 scalable fonts•3 bitmap LQ fonts•Friction feed with paper feeder•Up to 100 sheets at 64 gsm•Paper sizes: A4, Letter, Legal, Statement, Envelopes (DL No.10)•Accepts plain, special coated or glossy paper, and transparency film•Bi-directional parallel interface•Pack includes black & colour ink cartridges•397W x 206D x 144H mm

EPSON Stylus Black Ink Cartridge C92320.....$39.95
EPSON Stylus Colour Ink Cartridge C92330.....$59.95

EPSON STYLUS 820

720 X 360DPI ON SPECIAL COATED PAPER &GLOSSY PAPER



$509 TAX INC.

C92290 $419 TAX EX

Upgrade printhead and colour cartridge to make this printer become a Stylus Colour IIs!
Colour upgrade kit....$219 Cat No.92294

This is a 64-nozzle black inkjet printer (colour capable with optional colour upgrade kit)•Multi-layer Actuator print head technology •Print speed: 250 cps/LQ 20 cpi•Maximum resolution: 720 x 360 dpi•4 scalable fonts•3 bitmap LQ fonts•EPSON ESC/P2•Friction feed with paper feeder•Up to 100 sheets at 64 gsm•Paper sizes: A4, Letter, Legal, Statement, Envelopes (DL No.10)•Accepts plain, special coated or glossy paper, and transparency film•Bi-directional parallel interface•Exclusive ink cartridge•Dimensions: 397W x 206D x 144H mm

EPSON Stylus Black Ink Cartridge C92320.....$39.95
EPSON Stylus Colour Ink Cartridge C92330.....$59.95

STEAM ENGINE

$129

YES! STEAM (*DONKEY*) ENGINE- CAT No. A95000 Every child should have one of these. Great for mom and dad to play with as well.• Easy to operate•Runs on Methylated Spirits•Steam engine produces sufficient horsepower to run other mechanical toy apparatus•Easy To maintain, simply oil the appropiate parts•Operating instructions included

FREE ANNUAL CATALOGUE 1995-96

YES! I would like a free copy of Rod Irving Electronics' Annual Catalogue 1995-96 to be sent to me:-

Name .....

Address .....

.....

To: FREE POST **ROD IRVING ELECTRONICS P/L** REPLY PAID 8888, BAG 620, CLAYTON SOUTH, 3169.

SCCPUOCT95

LATEST CPU PRICE

intel CPU		AMD CPU	
486DX2-66 OverDrive Chip ..	$249	486DX4-100 *NEW!*.....	$189
486DX4-100 OverDrive Chip	$399	486DX4-120 *NEW!*.....	$269
PENTIUM 60MHz	$319	**CYRIX CPU**	
PENTIUM 66MHz	$469	486DX2-66 3.3V.....	$119
PENTIUM 75MHz	$499	486DX2-66 5V.....	$129
PENTIUM 90MHz	$599	486DX2-80 3.3V.....	$139
PENTIUM 100MHz	$699	486DX2-80 5V.....	$149
PENTIUM 120MHz	$1049	486DX4-100	$189
PENTIUM 133MHz	$1995		

AVAILABLE ON ORDER THROUGH OUR STORES OR BY MAIL ORDER

COMPUTER CARDS - HUGE RANGE!!

I.S.A.

CAT NO.	DESCRIPTIONS	PRICE
X18075	1Meg 16bit VGA	$159
X18196	Trident 9440 AGI VGA	$169
X18004	IDE/SPG	$39
X18013	IDE	$29
X17072	ADAPTEC SCSI 16bit 1522A	$189
X18161	*16bit ETHERNET NE2000 BNC	$69
X18165	16bit ETHERNET RJ45 + BNC	$79
X18169	16bit NE2000+	$119
X18159	Ethernet 10 base T Connector	$119
X18151	S.P.G.	$25
X18190	Printer 2-Port Slct Lpt 1-2 Card	$39
X18191	Printer Port Slct Lpt 1-2-3 Card	$49
X18141	High Speed Serial Card 1-Port 16550	$49.95
X18041	High Speed Serial Card 2-Port 16550AFN	$69
X18143	High Speed Serial Card 4-Port 16550AFN	$189
x18157	S.P.G with 16550 UART CHIP	$44.95
X18019	Games Card	$19
C14260	SMART GAMES Cont	$39.95
X18177	CD ROM Controller	$45
	2.88 FDD Controller Card	$125
X18514	*NEW!* Full-Duplex ISA Ethernet	$195

Specifications subject to changes. *X18161 without Boot Roms.

VESA LOCAL BUS

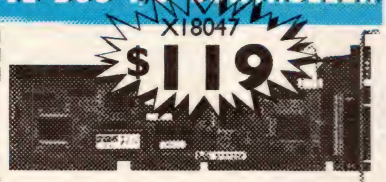
CAT.	DESCRIPTION	PRICE
X17078	VESA SCSI IDE FLOPPY MULTI I/O	$249
X18002	VESA MULTI I/O	$39
X18099	VESA 1 Meg TRIDENT 9400	$129
X18100	VESA CIRRUS 5428	$139
X18184	VESA PARADISE Bahamas 1Meg	$349
X18186	VESA IDE Cache Cont	$349
X17071	VESA SCSI 2, IDE, Floppy, Multi I/O	$299
X18087	VESA WD Accelerator Video Card	$209
X18167	VESA VGA S3 Accelerator	$169
X18185	VESA ET-4000 TSENG LABS	$199
X18149	VESA CLOUD9 VGA 2 MEG	$449
X18047	VESA IDE ENHANCED MULTI I/O	$119
X18182	VESA CACHED IDE MULTI I/O	$280

P.C.I.

CAT.	DESCRIPTION	PRICE
X17900	PCI 1M VGA TRIDENT 9440	$149
X18179	PCI IDE CONTROLLER	$39
X18181	PCI DIAMOND STEALTH 2MEG	$699
X18183	PCI VGA CIRRUS LOGIC 5430	$175
X18510	*NEW!* Full-Duplex PCI Ethernet	$149.95

LIGHTNING SPEED VL BUS I/O CONTROLLER

X18047 $119



Ideal for use with high speed external SCSI, tape drivers, external LAN adaptors, new generation high-speed printers.

FEATURES:

HIGH SPEED 16550 SERIAL PORTS

• Two individually-configurable high speed 16550 serial ports which are especially designed to keep high speed, external modems running at the fastest speed possible. • Flexible IRQ selection (IRQ 3, 4, 9, 10)

FLOPPY PORTS

• Supports up to two low and high-density floppy disk drives (2.88/1.44/ 1.2MB and 720/360KB) and Tape Drive.

ENHANCED IDE PORT

• Fully ATA-2, Fast ATA Compatible • Supports the following: Dual IDE channel, IDE hard disk >528MBytes (>1024 cylinders). Mode 3, 4 protocol, the data transfer rate of up to 11MBytes/Sec. IDE (ATAPI) CD-ROM, Tape backups. Special BIOS control, no driver needed for DOS/Windows. Fully user friendly. Jumperless design.

HIGH SPEED ECP/EPP BI-DIRECTIONAL PARALLEL PORT

• Fully compliant with IEEE 1284 standard • Fully compatible with external EPP to SCSI/ MO/CD-ROM/Tape Back Up devices.

SCCPUOCT-SEPT'95S

75/90/100 MOTHERBOARD

NEW

X18412 $399

This board corporates system board and PCI IDE in one board that provides all the PC solution. The mainboard is a Pentium TM micro processor based PC/AT system, supports 256KB to 1MB cache with ISA Bus and PCi Local Bus to upgrade your system performance. Ideal for multi-tasking and fully supports MS DOS, Windows/NT, Novell, OS/2, etc.

FEATURES: ***TRITON CHIPSET***

• **Green Functions-** Supports power management operation via BIOS. Power down timer from 0.25 to 512 mins. Green mode selection via software or hardware.

• **CPU-** The Pentium micro processor P54C provides power performance for high-end workstations and servers.• **Speed-** Supports 75/90/100/120/132MHz CPU speed. Supports 25/30/33MHz PCI LOCAL BUS speed. Speed selection via software. I/O clock 8MHz for ISA Bus.

• **DRAM Memory-** Supports 4 banks (4pcs) 72-pin 1/2/4/8/16/32MB SIMM module socket. Supports DRAM memory up to 128MB on board. DRAM type: page mode, 70ns required.• **Cache Memory-** Cache SRAM size from 256K to 1MB, write back.

• **Bus Slots-** Five 16-bit ISA Bus slots and three PCI Local Bus Slots

• **PCI Enhanced IDE Built-in On Board-** Supports following: 4 IDE hdd Mode, 3 high performance hdd. IDE interface CD-ROM. High capacity hdd.

PLEASE SEND ALL MAIL ORDERS TO:
MAIL ORDER DEPARTMENT, ROD IRVING ELECTRONICS PTY. LTD., LOCKED BAG 620, ROSEBANK MDC, CLAYTON SOUTH, VIC 3169.

☐ **MELBOURNE:** 48 A'BECKETT ST, MELBOURNE 3000. •PH: (03) 663 6151 •FAX: (03) 639 1641 •Mon-Thurs: 9.00-5.30pm •Fri: 9.00-8.00pm •Sat: 9.00-1.00pm

☐ **VERMONT:** 190 ROOKS RD, VERMONT 3133 •PH: (03) 874 8888 •FAX: (03) 874 2288 •Mon-Fri: 9.00-5.30pm •Sat: 9.00-1.00pm

☐ **OAKLEIGH:** 240C HUNTINGDALE RD, OAKLEIGH 3166 •PH: (03) 562 8939 •FAX: (03) 562 8940 •Mon-Fri: 9.00-5.30pm •Sat: 9.00-1.00pm

☐ **NORTHCOTE:** 423 HIGH ST, NORTHCOTE 3070. •PH: (03) 489 8866 •FAX: (03) 489 8131 •Mon-Fri: 9.00-5.30pm •Sat: 9.00-1.00pm

☐ **BOX HILL:** 1031 MAROONDAH HWY, BOX HILL 3128. •PH: (03) 899 6033 •FAX: (03) 899 0156 •Mon-Fri: 9.00-5.30pm •Sat: 9.00-3.00pm

☐ **CLAYTON:** 56 RENVER RD, CLAYTON 3168. •PH: (03) 543 7877 •FAX: (03) 543 8295 •Mon-Fri: 9.00-5.30pm •Sat: 9.00-12.00pm

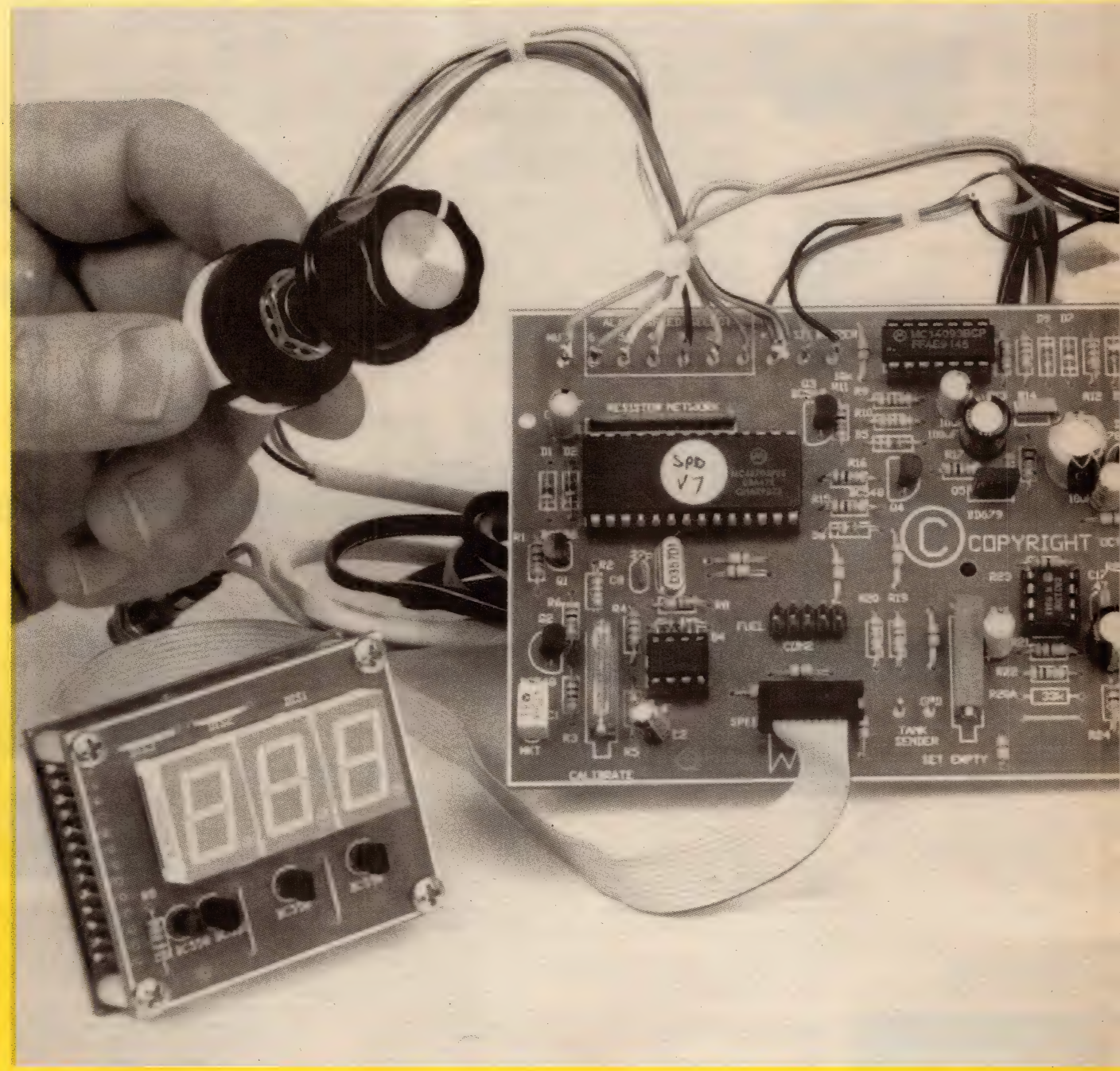
☐ **BLUESTAR COMPUTERS:** 271 MAROONDAH HWY, RINGWOOD 3134. •PH: (03) 870 1800 • FAX: (03) 879 3027 •Mon-Fri: 9.00-5.30pm •Sat: 9.00-1.00pm

☐ **SYDNEY:** 74 PARRAMATTA RD, STANMORE 2048. • PH: (02) 519 3888 • FAX: (02) 516 5024 •Mon-Thrs: 9.00-5.30pm •Sat: 9.00-1.00pm

☐ **ADELAIDE:** 241-243 WRIGHT ST, ADELAIDE 5000. • PH: (08) 211 7200 • FAX: (08) 211 7273 •Mon-Thurs: 9.00-5.30pm •Fri: 9.00-8.30pm •Sat: 9.00-5.00pm •Sun: 10.00-4.00pm

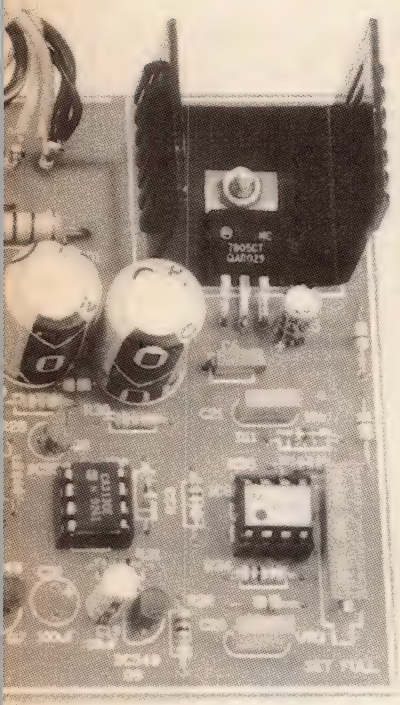
ERRORS & OMISSION EXCEPTED. PRICES CHANGE WITHOUT NOTICE. WINDOWS IS A REGISTERED TRADEMARK OF MICROSOFT CORPORATION IN THE U.S. AND OTHER COUNTRIES

Digital speedom & fuel gauge



eter

Update your car's dashboard to this fancy electronic display. It gives digital readouts of speed and the fuel remaining, and includes a 6-position overspeed alarm as well.



Pt.1 – By JEFF MONEGAL

Many modern cars have digital instrument panels and these are preferred by some people because they are easy to read at night. Not only that but they look fancy as well. If your car's dashboard could do with an update, this electronic version will do the job.

To simplify things as much as possible, the circuit is based on a Motorola 68705P3 microprocessor. This accepts inputs from a speed sensor, the fuel tank sender (via an A-D converter) and an overspeed switch and provides outputs to drive the displays, alarm buzzer and warning lamp.

The speedo display consists of a 3-digit 7-segment LED module which directly indicates the speed in km/h (kilometres per hour). An identical 3-digit display module is used for the "fuel gauge" and can display the fuel remaining in the tank in either litres, gallons or as a percentage (set during the calibration procedure). Both the speedo and fuel displays are automatically dimmed at night, so that they are not too bright.

A dash-mounted "low-fuel" warning lamp lights when the reading drops below 9 (ie, below 9 litres, 9 gallons or 9%). As the amount of fuel in the tank hovers around 9, the lamp will slowly switch on and off as the fuel sloshes around in the tank.

There are six overspeed alarms and these are selected by the driver using a simple rotary selector switch. The alarm speeds chosen are 62, 72, 82, 92, 102 and 120km/h. These figures were chosen to allow the driver to sit comfortably on the speed limit while still providing sufficient warning if the limit is exceeded.

If the preset speed is exceeded, the circuit immediately sounds a buzzer and flashes the speedo display at a 1Hz rate (ie, once every second). This continues for as long as the preset speed is exceeded but, if necessary, the buzzer can be silenced for 30 seconds by pressing an "Alarm Mute" button. The display continues to flash even after the Alarm Mute button has been pressed, unless the speed drops back below the warning threshold.

How it works

Fig.1 shows the main circuit details of the Digital Dashboard. As indicated earlier, most of the action takes place inside IC2, the 68705P3 microprocessor. Crystal X1 (3.58MHz) and capacitor C8 (27pF) are the external clock components, while Q2 and IC1 are used to generate the interrupts. This circuit works as follows.

When power is first applied, C1 charges via a 1MΩ 10-turn trimpot (VR1). As the voltage across C1 rises, the voltage on pin 2 of comparator IC1 eventually exceeds the 4V bias voltage on pin 3 (set by R4 & R5) and the output at pin 6 switches low. This, in turn, forward biases D4 and provides

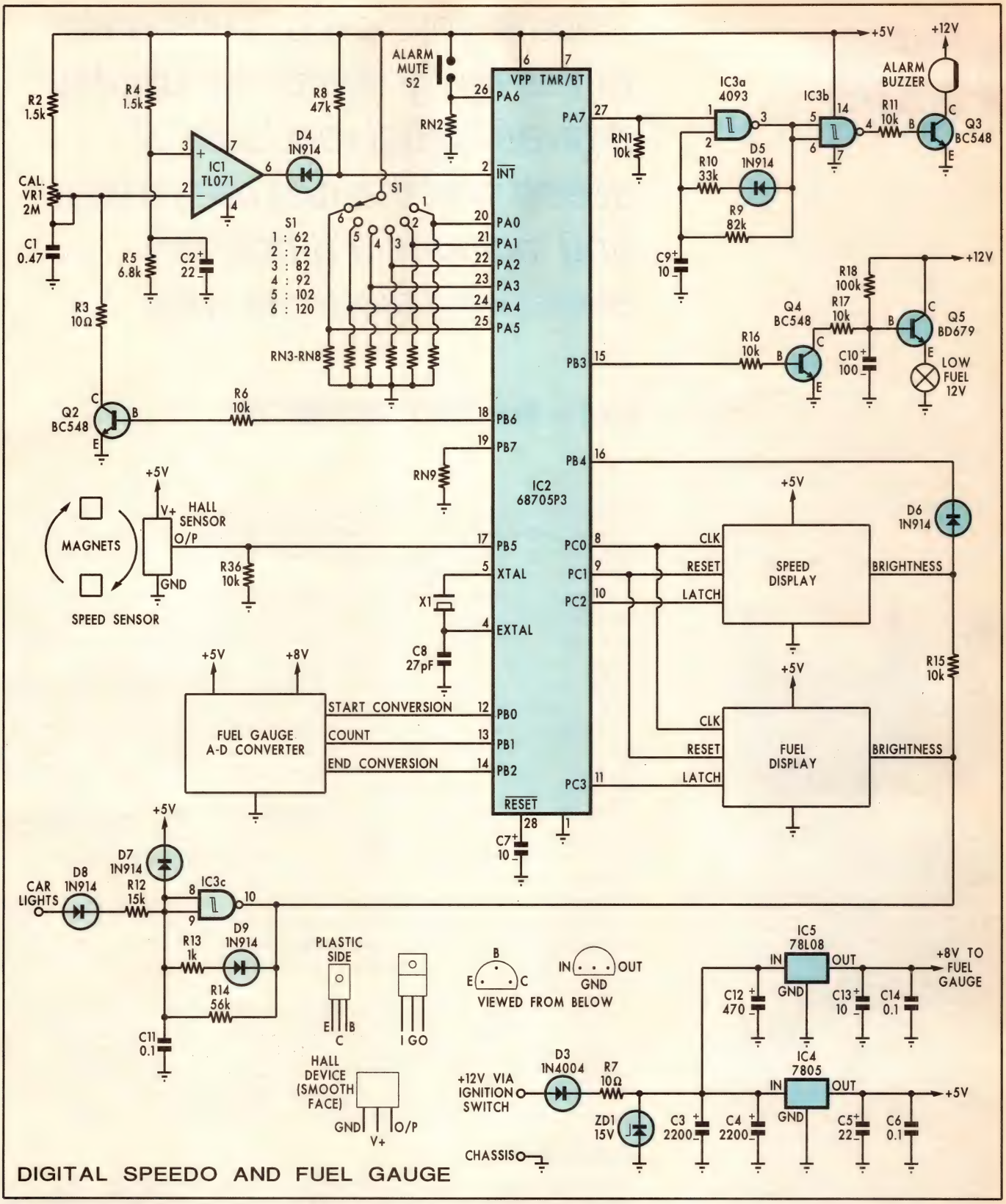


Fig.1: the circuit is based on IC2 which is a 68705P3 microprocessor. It accepts pulses from a speed sensor and the fuel gauge A-D converter and drives the speed and fuel displays. It also drives an overspeed alarm buzzer (via IC3) and a low-fuel lamp via Q4 and Q5.

an interrupt signal to the microprocessor (IC2) which then executes an interrupt routine in its software.

During this interrupt routine, pin 18 (PB6) of IC2 briefly goes high and turns on Q2. This discharges C1 and thus resets the interrupt timebase. VR1 sets the timebase frequency to provide calibration of the speed display, while C2 decouples the bias voltage set by R4 & R5.

A Hall Effect device is used as the speed sensor. It provides a 5V signal

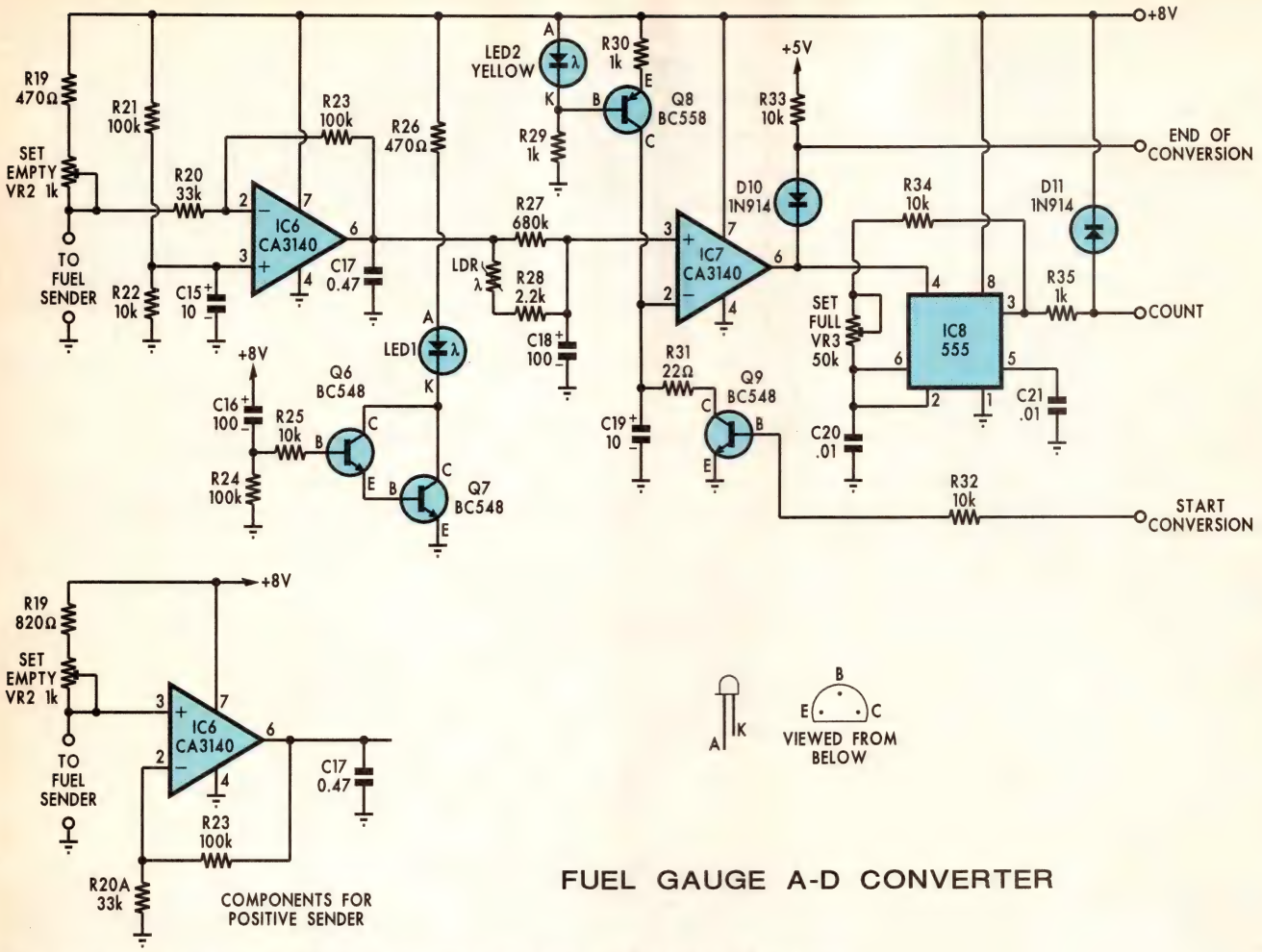


Fig.2: this circuit converts the analog output of the fuel sender to a digital signal that can be applied to the microprocessor. IC6 functions as an amplifier and this drives comparator IC7 which, in turn, controls oscillator stage IC8.

at its output each time a magnet passes its sensitive area. In practice, two magnets are used and these are secured to the drive shaft of the vehicle, with the Hall Effect device mounted nearby – see Fig.7.

The output from the Hall Effect device is fed to pin 17 (PB5) of IC2. Note that the output is normally pulled low via a 10kΩ resistor to ground.

The signals to drive the speed display module appear at pins 8-10 (PC0-PC2) of IC2. These signal lines are labelled Clk, Reset and Latch. Note that the same Clk and Reset lines are also applied to the fuel display module. Only the Latch signals are different, the fuel display module being driven from pin 11 (PC3) of IC2.

Speed buzzer & dimming

Pin 27 (PA7) of IC2 is the speed alarm output. This output switches high when the vehicle's speed exceeds the overspeed setting, as selected by switch S1. Depending on its position, S1 simply pulls one of the PA0-PA5 inputs (pins 20-25) to +5V. The remaining inputs are normally held low by 10kΩ resistors RN3-RN8 (part of a resistor array).

When the set speed is exceeded and pin 27 goes high, it activates a Schmitt trigger oscillator based on IC3a. R9, R10, D5 & C9 set the oscillator frequency to about 3Hz, with the output appearing at pin 3. This drives transistor Q3 via inverter stage IC3b to pulse the buzzer on and off.

IC3c is also connected as a Schmitt trigger oscillator but in this case is used as a brightness control for the two display modules. This oscillator is permanently enabled since pins 8 & 9 of IC3c are connected together.

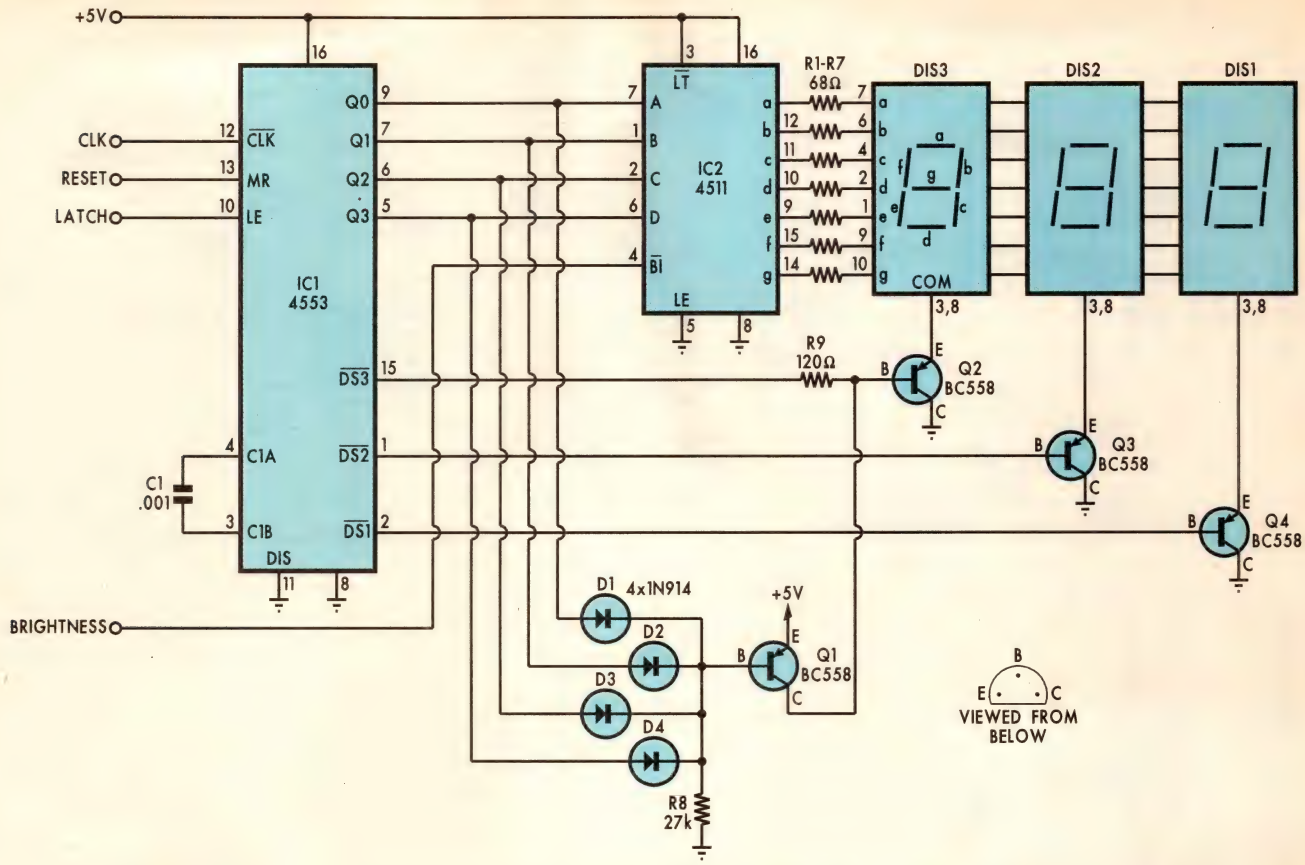
When the car's lights are off, the duty cycle is about 50:1, as set by R13 and D9 in the feedback path. The output appears at pin 10 of IC3c and drives the blanking input (pin 4) of a 4511 display driver in each display module.

If, however, the lights are turned on, D8 becomes forward biased which means that R12 is effectively connected in parallel with R14 each time pin 10 of IC3c goes high. This reduces the duty cycle to about 12:1 and this in turn considerably reduces the brightness of the displays.

D7 is necessary to protect IC3 against excessive voltage (+12V) from the lights circuit. It does this by clamping the inputs of IC3c (pins 8 & 9) to the +5V rail – ie, pins 8 & 9 of IC3c can never rise above 5.6V.

Low fuel lamp

Q4 and Q5 control the low fuel lamp. When the microprocessor detects low fuel (via an A/D converter), pin 15 (PB3) switches low. This turns Q4 off and so C10 slowly charges via R18. As the voltage across C10 rises, the voltage on the emitter of Darlington transistor Q5 also rises and so the lamp gradually turns on to full brilliance.



SPEEDOMETER/FUEL GAUGE DISPLAY

Fig.3: the display driver circuit is based on a 4553 3-digit counter (IC1) and a 4511 BCD to 7-segment decoder (IC2). The displays are multiplexed by using IC1 to switch driver transistors Q2, Q3 and Q4 on and off at the appropriate times. Diodes D1-D4 and transistor Q1 provide leading zero blanking.

Conversely, if the microprocessor detects more than 9 (gallons, litres or percent) in the fuel tank, pin 15 goes high. This turns on Q4 which discharges C10 and the low fuel lamp dims to off.

R18 and C10 set the lamp dimming time constant to about 10 seconds. As well as ensuring that the lamp gradually comes up to full brilliance at the low fuel point, it also prevents the lamp from rapidly fluctuating between on and off as the fuel sloshes around in the tank.

Power supply

Power for the circuit is derived from the car's battery via the fusebox. D3 provides reverse polarity protection, while R7 and ZD1 provide protection against any abnormally high voltage spikes that may be present. The resulting +12V rail is then filtered using C3 and C4 and fed to 3-terminal regulator IC4 which provides a +5V rail.

This +5V rail is used to power the ICs, the timebase circuitry and the LED display modules. In addition, a second 3-terminal regulator, IC5, is used to provide a +8V rail to power the A/D converter circuitry. The low-fuel lamp driver circuit (Q4 & Q5) and the buzzer driver circuit (Q3) are powered from a +12V rail derived from the input to IC4.

A/D converter

Fig.2 shows the fuel gauge A/D converter circuit. This circuit is necessary to convert the analog output of the existing fuel sender in the car to a digital signal that can be applied to the microprocessor (IC2).

The sender in most cars consists of a rheostat with the movable arm connected to some sort of float arrangement. When the tank is full, the resistance is at minimum. Conversely, maximum resistance is obtained when the tank is empty.

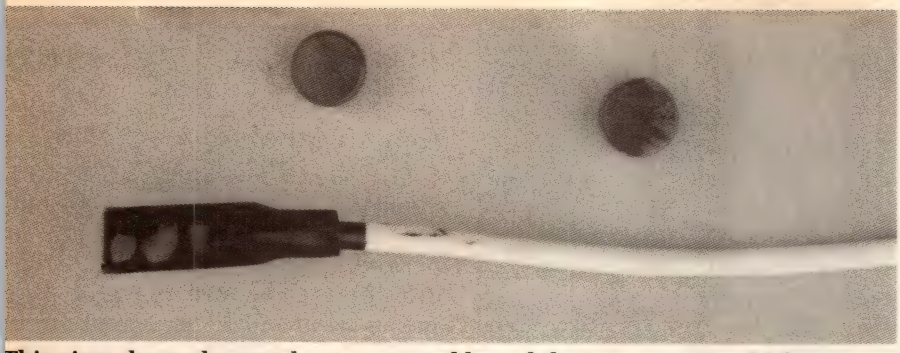
However, some vehicles have fuel senders that work in the opposite sense. This type of sender is catered for by making a few minor changes to the input circuitry, as shown on Fig.2. Note, however, that the circuit will not work with cars that have capacitive type fuel senders. To our knowledge, the only vehicle that uses this type of sender is the Ford Falcon range from model XD and on.

Tests showed that the resistance of most senders varies from 0Ω when full to 2kΩ or more when empty. As the resistance varies, in response to a changing fuel level, the voltage applied to the inverting input (pin 2) of IC6 varies accordingly.

IC6 is wired as an inverting op amp with a gain of three, as set by R23 and R20. R21 and R22 bias its non-inverting input to about 0.7V, while the amplified signal output appears at pin 6. As the fuel level falls, the voltage at pin 6 also falls and vice versa.

Following IC6, the signal passes via a filter network (R27 & C18) to pin 3 of comparator stage IC7. This filter network provides a long time constant (68s) to prevent short-term fluctuations in the reading as the fuel sloshes around in the tank.

Q8, LED 2, R29 and R30 form a constant current source and this charges C19. The resulting linear saw-



This view shows the speed sensor assembly and the two magnets which are mounted on the tailshaft (or on a drive shaft). The sensor assembly is covered in heatshrink tubing and sealed with silicone sealant to make it waterproof.

tooth waveform is applied to pin 2 of IC7 and compared with the DC voltage across C18.

When the microprocessor starts the conversion process, its pin 12 output (PB0) pulses high. This briefly switches on Q9 which discharges C19. As a result, pin 6 of IC7 goes high and this starts an oscillator stage based on 555 timer IC8.

C19 now charges via the constant current source (Q8). When the voltage on pin 2 of IC7 rises above that on pin 3, pin 6 switches low and stops the oscillator. At the same time, it pulls pin 14 (PB2) of the microprocessor low via D10 to signal the end of conversion (EOC). Note that D10 and R33 provide 8V to 5V level translation for the microprocessor.

During the conversion process, the microprocessor counts the pulses at the pin 3 output of the oscillator (IC8). This count is then processed and the resulting information used to indicate the amount of fuel in the tank. VR2 provides the zero calibration when the tank is empty, while VR3 adjusts the frequency of the oscillator and allows the reading to be correctly set when the tank is full.

The circuit based on Darlington pair Q6 and Q7 is used only at power on. Because of the long time constant formed by C18 & R27, the fuel readout would not otherwise be accurate for several minutes when the ignition is first turned on. This problem is solved as follows.

When power is first applied, C16 pulls the base of transistor Q6 high via R25. This switches on the Darlington pair (Q6 & Q7) and lights LED 3. This LED is positioned against the face of an LDR connected to pin 6 of IC6. As a result, when the LED turns on, it lowers the resistance of the LDR to just a few hundred ohms.

C18 can now charge up quite quickly via the LDR & R28 and so the correct fuel level is displayed almost immediately after the ignition is switched on.

In the meantime, C16 charges via R24. After a few seconds, Q6, Q7 and LED 1 turn off and the resistance of the LDR rises to over 5MΩ. As a result, C18 now mainly charges via R27 and so the time constant is increased to over one minute to prevent fluctuations due to fuel slosh as described previously.

Fig.2 also shows the alternative circuit for fuel senders that work in the opposite sense to normal (ie, low resistance when the tank is empty; high resistance when the tank is full). In this case, IC6 is configured as a non-

WARNING!

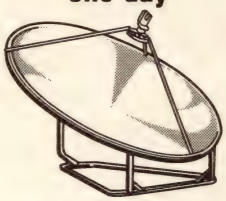
The fuel gauge circuit in this design derives its input from the car's existing fuel sender. As a result, the existing fuel gauge in the car must be disconnected and is thus rendered inoperative.

If you don't want to do this, then you might consider building only the digital speedometer section of the design. Alternatively, you can install a 2-position switch (with break before make contacts) to select between the existing fuel gauge and the digital fuel display.

Finally, readers are reminded that it is illegal to tamper with a car's odometer. In particular, it should not be disabled or removed from the vehicle.

YOU CAN NOW AFFORD YOUR OWN SATELLITE TV SYSTEM

For many years you have probably looked at satellite TV systems and thought "one day"



Your own K-band system from only:

$995

HERE'S WHAT YOU GET:

- Prime focus dish configured to your location.
- Super low noise LNB/feedhorn.
- 25m low loss coaxial cable.
- DYNALINK 50 channel stereo satellite receiver, with remote control. Pre-programmed to Optus frequencies.
- Pointing co-coordinates for your location.

BEWARE OF IMITATORS

Direct Importer: AV-COMM PTY. LTD.

PO BOX 225, Balgowlah NSW 2093
Tel: (02) 9949 7417 Fax: (02) 9949 7095

Ask about our regular newsletters and Customer BBS. Send coupon for your free info pack, listing all items and prices.

YES GARRY, please send me more information on K-band satellite systems.

Name: _____

Address: _____

_____ P'code: _____

Phone: _____

ACN 002 174 478

PARTS LIST

MAIN MODULE

1 main PC board, 168 x 85mm
2 10-way ribbon cables with IDC sockets
2 10-way PC-mount IDC plugs
1 case to suit (not part of kit)
1 12V mini buzzer
2 button magnets
1 U-shaped heatsink to suit
1 6-position single-pole rotary switch (S1)
1 momentary contact pushbutton switch (S2)
1 knob to suit rotary switch
1 1MΩ 10-turn trimpot (VR1)
1 1kΩ 10-turn trimpot (VR2)
1 50kΩ 10-turn trimpot (VR3)
1 12V panel-mount lamp & bezel
1 28-pin IC socket
1 14-pin IC socket
4 8-pin IC sockets

Semiconductors

IC1 – TL071/TL081 op amp
IC2 – 68705P3 programmed microprocessor
IC3 – 4093 quad Schmitt trigger
IC4 – 7805 regulator
IC5 – 78L08 regulator
IC6,IC7 – CA3130 op amp
IC8 – 555 timer
Q2,Q3,Q4,Q6,Q7,Q9 – BC548 NPN transistor
Q5 – BD679 Darlington transistor
Q8 – BC558 PNP transistor
D3 – 1N4004 silicon diode
D4,D5,D6,D7,D8,D9,D10, D11 – 1N914 silicon diode
ZD1 – 15V 1W zener diode
LED1 – 5mm high brightness LED
LED2 – 3mm yellow LED
X1 – 3.58MHz crystal
1 Hall Effect sensor

Capacitors

C1 – 0.47µF MKT
C2,C5 – 22µF 16VW electrolytic
C3,C4 – 2200µF 16VW electrolytic
C6,C11,C14 – 0.1µF monolithic
C7,C9,C13,C15,C19 – 10µF 16VW electrolytic
C8 – 27pF ceramic
C10,C16,C18 – 100µF 16VW electrolytic
C12 – 470µF 16VW electrolytic
C17 – 0.47µF monolithic
C20 – .01µF MKT
C21 – .01µF monolithic

Resistors (0.25W, 5%)

R2,R4 – 1.5kΩ
R13,R29,R30,R35 – 1kΩ
R3 – 10Ω
R5 – 6.8kΩ
R6,R11,R15,R16,R17,R22,R25,R32, R33,R34,R36 – 10kΩ
R7 – 10Ω 1W
R8 – 47kΩ
R9 – 82kΩ
R10, R20,R20a – 33kΩ
R12 – 15kΩ
R14 – 56kΩ
R18,R21,R23,R24 – 100kΩ
R19 – 470Ω or 820Ω (see test)
R26 – 470Ω
R27 – 680kΩ
R28 – 2.2kΩ
R31 – 22Ω
RN1-9 – 10kΩ resistor network
1 LDR (as supplied)

DISPLAY MODULE

(1 each required for speedo and fuel displays)

2 PC boards, 56 x 46mm
4 12mm spacers
1 10-way PC-mount IDC plug
1 red perspex sheet
2 16-pin IC sockets

Semiconductors

D1,D2,D3,D4 – 1N914 silicon diode
Q1,Q2,Q3,Q4 – BC558 PNP transistor
IC1 – 4553 3-digit BCD counter
IC2 – 4511 BCD to 7-segment LED display driver
DIS1,DIS2,DIS3 – 7-segment LED display

Capacitors

C1 – .001µF ceramic

Resistors (1/4W, 5%)

R1-R7 – 68Ω
R8 – 27kΩ
R9 – 120kΩ

Where to buy parts

Kits for this design will be available from CTOAN Electronics and this company has retained copyright of the PC board designs.

inverting amplifier instead of being an inverting amplifier. The remainder of the circuit is identical.

Display modules

Fig.3 shows the circuit for the two display modules (ie, the speedo and fuel displays).

IC1 is a 4553 3-digit counter with multiplexed outputs. It counts the pulses on its clock input from pin 8 (PC0) of the microprocessor and outputs the resulting data in BCD form. This data appears on the Q0-Q3 outputs of IC1 and drives IC2 which is a BCD to 7-segment decoder. IC2 in turn drives the a-g segments of the LED displays via current limiting resistors R1-R7.

The displays are multiplexed by using IC1 to switch driver transistors Q2, Q3 and Q4 on and off at the appropriate times.

A crude form of leading zero blanking is used to blank the leading digit (DIS1) when ever its value is zero. This is achieved using diodes D1-D4 and transistor Q1.

D1-D4 monitor the Q1-Q4 BCD outputs of IC1. When the leading digit has a value of zero, the four BCD outputs will all be low and so D1-D4 will all be reverse biased. As a result, Q1's base is pulled low via R8 and so Q1 turns on and Q2 turns off and blanks the leading display digit.

For other leading digit values, one or more of the BCD lines from IC1 will be high. Because D1-D4 effectively form a 4-input OR gate, Q1's base will also be high. Thus, Q1 will be held off and Q2 operates as normal.

Note that no blanking has been applied to the second digit (DIS2), as this would add greatly to the circuit complexity. In any case, this digit only reads "0" on the speed display when the vehicle is travelling at less than 10km/h, and "0" on the fuel display when there is less than 9 litres (or gallons, or percent) remaining in the fuel tank.

The clock, latch and reset signals for the display module come from the microprocessor (IC2 on the main board), while the brightness signal comes from pin 10 of oscillator stage IC3c as described previously.

Next month, we shall give the full constructional details and describe the calibration procedure. Note that several kit versions will be available from CTOAN Electronics. **SC**

ANOTHER GREAT DEAL FROM MACSERVICE

100MHz Tektronix 465M Oscilloscope
2-Channel, Delayed Timebase

$900

VERTICAL SYSTEM
Bandwidth & Rise Time: DC to 100MHz (-3dB) and 3.5ns or less for DC coupling and -15°C to +55°C.
Bandwidth Limit Mode: Bandwidth limited to 20MHz.
Deflection Factor: 5mV/div to 5V/div in 10 steps (1-2-5 sequence). DC accuracy: ±2% 0-40°C; ±3% -15-0°C, 40-55°C. Uncalibrated, continuously variable between settings, and to at least 12.5V/div.
Common-Mode Rejection Ratio: 25:1 to 10MHz; 10:1 from 10-50MHz, 6cm sinewave. (ADD Mode with Ch 2 inverted.)
Display Modes: Ch 1, Ch 2 (normal or inverted), alternate, chopped (250kHz rate), added, X-Y.
Input R and C: 1MΩ ±2%; approx 20pF.
Max Input Voltage: DC or AC coupled ±250VDC + peak AC at 50kHz, derated above 50KHz.

HORIZONTAL DEFLECTION
Timebase A: 0.5s/div to 0.05µs/div in 22 steps (1-2-5 sequence). X10 mag extends fastest sweep rate to 5ns/div. **Timebase B**: 50ms/div to 0.05µs/div in 19 steps (1-2-5 sequence). X10 mag extends maximum sweep rate to 5ns/div. **Horizontal Display Modes**: A, A Intensified by B, B delayed by A, and mixed.

CALIBRATED SWEEP DELAY
Calibrated Delay Time: Continuous from 0.1µs to at least 5s after the start of the delaying A sweep.
Differential Time Measurement Accuracy: for measurements of two or more major dial divisions: +15°C to +35°C 1% + 0.1% of full scale; 0°C to +55°C additional 1% allowed.

TRIGGERING A & B
A Trigger Modes: Normal Sweep is triggered by an internal vertical amplifier signal, external signal, or internal power line signal. A bright baseline is provided only in presence of trigger signal. Automatic: a bright baseline is displayed in the absence of input signals. Triggering is the same as normal-mode above 40Hz. Single (main time base only). The sweep occurs once with the same triggering as normal. The capability to re-arm the sweep and illuminate the reset lamp is provided. The sweep activates when the next trigger is applied for rearming.
A Trigger Holdoff: Increases A sweep holdoff time to at least 10X the TIME/DIV settings, except at 0.2s and 0.5s.
Trigger View: View external and internal trigger signals; Ext X1, 100mV/div, Ext -: 10, 1V/div.
Level and Slope: Internal, permits triggering at any point on the positive or negative slopes of the displayed waveform. External, permits continuously variable triggering on any level between +1.0V and -1.0V on either slope of the trigger signal.
A Sources: Ch 1, Ch 2, NORM (all display modes triggered by the combined waveforms from Ch 1 and 2), LINE, EXT, EXT :-10. **B Sources**: B starts after delay time; Ch 1, Ch 2, NORM, EXT, EXT :-10.

X-Y OPERATION
Sensitivity: 5mV/div to 5V/div in 10 steps (1-2-5 sequence) through the vertical system. Continuously variable between steps and to at least 12.5V/div.
X Axis Bandwidth: DC to at least 4MHz; **Y Axis Bandwidth:** DC to 100MHz; **X-Y Phase**: Less than 3° from DC to 50kHz.

DISPLAY
CRT: 5-inch, rectangular tube; 8 x 10cm display; P31 phosphor. **Graticule**: Internal, non-parallax; illuminated. 8 x 10cm markings with horizontal and vertical centerlines further marked in 0.2cm increments. 10% and 90% markings for rise time measurements. **Graticule Illumination**: variable. **Beam Finder**: Limits the display to within the graticule area and provides a visible display when pushed.

MACSERVICE PTY LTD *Australia's Largest Remarketer of Test & Measurement Equipment*
20 Fulton Street, Oakleigh Sth, Vic., 3167. Tel: (03) 9562 9500; Fax: (03) 9562 9590
****Illustration is representative only**

SILICON CHIP

SILICON CHIP FLOPPY INDEX

Now available: the complete index to all SILICON CHIP articles since the first issue in November 1987. Now you can search through all the articles ever published for the one you want. Whether it is a feature article, a project, a circuit notebook item, an article by one of our regular contributors or a major product review, it does not matter; they are all there, for you to browse through.

The index comes as an ASCII file on a 3.5-inch or 5.25-inch floppy disc to suit IBM compatible computers and you can use any word processor program to search using a keyword such as "Amplifier".

The Floppy Index is available throughout Australia for $6 plus $3 postage and packing. You nominate 3.5-inch or 5.25-inch format.

Send your order to SILICON CHIP, PO Box 139, Collaroy, NSW 2097; or fax your order to (02) 9979 6503; or ring (02) 9979 5644 and quote your credit card number. We accept credit card authorisations for Bankcard, Visacard and Mastercard.

Silicon Chip Binders

These beautifully-made binders will protect your copies of SILICON CHIP.

★ Heavy board covers with 2-tone green vinyl covering
★ Each binder holds up to 14 issues
★ SILICON CHIP logo printed in gold-coloured lettering on spine & cover

Price: $A11.95 plus $3 p&p each (NZ $6 p&p).

Just fill in & mail the order form on page 31; or fax (02) 9979 6503; or ring (02) 9979 5644 & quote your credit card number.

PRODUCT SHOWCASE

Hands-free auto-scanning

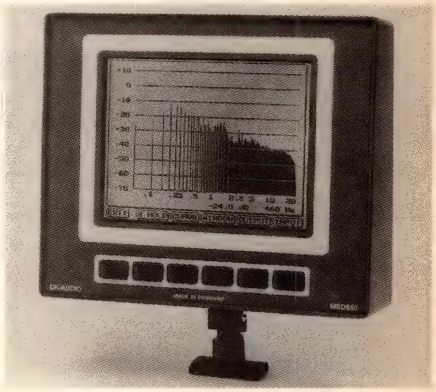
Teklogix has introduced Scan-See, a new integrated barcode scanner/remote RF terminal. Weighing just over 125 grams, Scan-See is fitted to the back of the operator's hand by a Velcro strap and automatically scans barcodes whenever they are within range (from about 40mm to 150mm).

Scan-See is used in conjunction with a standard hand-held Teklogix RF terminal, which the operator places in a comfortable position, such as on their hip. Operating as a remote extension of the 32-bit Teklogix RF terminal, Scan-See delivers sub-second response times, with data shown on a 2 x 10 LED display. For applications which require more data on the screen, a 2 x 20 LCD version is available.

Two-way communication is provided through an integrated UHF FM or spread spectrum radio, with data being transmitted and received at rates of up to 122,000 bps (bits per second). An advanced protocol error detection and message retransmission feature ensures data integrity and when used on a multiple channel system, the terminal has an automatic cellular channel selection feature which looks and switches to the clearest radio channel.

For further information, contact Information Technologies Division, Colby Demag, 75 South Creek Road, Dee Why, NSW 2099. Phone (02) 981 5555 or fax (02) 971 9643.

Master stereo displays from Amber

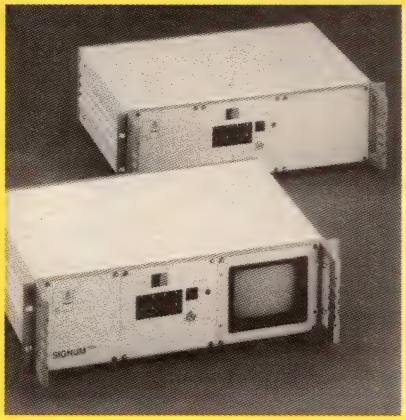


Amber Technology has announced additions to the range of DK-Audio master stereo displays, the MSD550E

Monitor and keyboard selector

Signum Plus allows the control of up to eight PCs from a single keyboard and monitor. Intended for applications in PC networks and control systems, it cuts down the investment costs of up to seven keyboards and monitors, while also saving on energy, running costs and space.

Additional benefits include reduced heat losses which eliminate excessive thermal loads within racks and within air-conditioning systems. A second monitor can be operated simultaneously in the



system with the internal monitor and activity on individual PCs can be monitored from a single workstation with a clear display and control unit.

Signum Plus incorporates an integrated keyboard lock which protects the system against unauthorised access and the system can function as a 19-inch chassis or bench case. Among the options available is the ability to reboot all PCs at the same time, to have channel control from the PC keyboard and to position the keyboard and monitor up to 1300 metres from the PCs.

For further information, contact Ricon Pty Ltd, 66-76 Dickson Avenue, Artarmon, NSW 2064. Phone (02) 439 6078.

enhanced stereo display and the MSD550LR level recorder. DK-Audio's new MSD550E offers all of the functions of the original model with the advantage of a new microprocessor, faster operation and greater memory capacity. The MSD550E is also fitted with stereo peak level LED indicators as standard. The MSD-550E may also be ordered fitted with DK-Audio's FFT spectrum analyser package, an integral 1024-band Fast Fourier Transformation real time audio analyser.

For further information, contact Amber Technology, Unit B, 5 Skyline Place, Frenchs Forest, NSW 2086. Phone (02) 975 1211 or fax (02) 975 1368.

PC-based analog interface

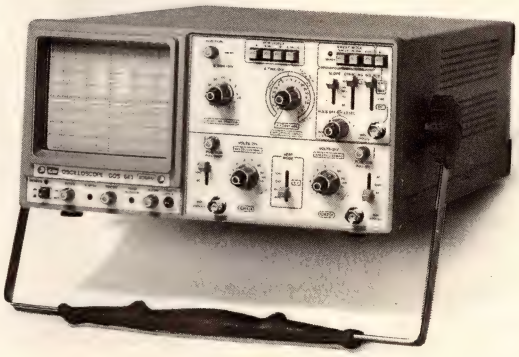
This recently released Analog Interface Unit (AIU) is the first in a series of easily programmed PC-based data acquisition devices to be released by Advanced R&D Solutions.

The AIU is a general purpose "dongle" sized unit that plugs directly into the parallel port on a PC. It contains an 8-bit resolution ADC and DAC with selectable true bipolar input/output ranges, entirely powered from the PC's port.

Complete driver routines are supplied, to allow the user to program and create customised applications. Example programs are provided for different languages, to show how the driver routines work.

The AIU is available in kit form for $95 (incl. p&p) or $120 fully assembled. For further details, contact Advanced R&D Solutions, 12 Copeland Road, Lethbridge Park, NSW 2770. Phone or fax (02) 628 1223.

50MHz
Only $1,076*



GW Instruments is one of only 2 Taiwanese manufacturers of test and measuring instruments to be certified to the ISO9002 Quality Standard. This certification is your guarantee of a quality, yet most affordable 50MHz, 2CH scope available.

Features of the GW GOS-653 Oscilloscope include:

- *50MHz, 2 Channels*
- *Maximum Sensitivity of 1mV/DIV*
- *Auto Trigger Level Lock uses a special pk-pk detector*
- *Alternate Trigger Mode to trigger asynchronous signals*
- *Variable Hold-Off ensures easy viewing of complex signals*
- *DC Trigger coupling for viewing low frequency signals*
- *Signal delay line to display leading edge*
- *12kV acceleration Voltage for bright display*
- *Channel 1 signal output can be connected to other instruments*

** Price quoted includes probes and excludes sales tax*

EMONA INSTRUMENTS

Available from Emona Offices Australia Wide:

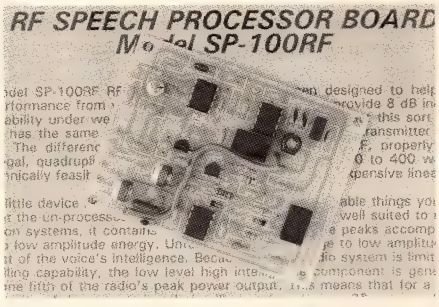
NSW (02) 519 3933 QLD (07) 397 7427
VIC (03) 889 0427 WA (09) 361 4200

Also available from dealers around Australia.

RF speech processor for SSB radios

This product is claimed to provide an 8dB increase in signal readability in weak and noisy receive conditions for SSB transmissions – equivalent to increasing the transmitter power by four times. The difference is that this modification is legal and cheaper.

The SP-100RF speech processor achieves its stated aim by virtue of the fact that the human voice is not well suited to SSB or AM radio communications which are not able to cope with large peak powers. The human voice has high amplitude peaks accompanied by lots of average to low level signals. It is the average to low level signals which contain most of the voice's intelligence. However, the



SP-100RF does not work by compressing the audio signal. Instead, it processes the voice modulation at RF, us-

ing its own internally generated SSB signal. This is claimed to give a cleaner output waveform and more effective "talk power".

The SP-100RF, a fully assembled PC board, is priced at $121 plus freight. For more information, contact the Australian manufacturers, GFS Electronics, PO Box 97, Mitcham, Vic 3132. Phone (03) 9873 3777 or fax (03) 9872 4550.

High-speed, fibre-optic GPIB extender

National Instruments has announced a high-speed, software-transparent, fibre-optic GPIB extender.

The GPIB-140 transfers data at up to 2.2Mb/s using the HS488 protocol and up to 1.05Mb/s using IEEE 488.1 transfers while keeping the cabling cost at a minimum. The GPIB-140 extends the maximum GPIB cable length from 20m to 1km without compromising the integrity of the GPIB or requiring any application program modifications.

The GPIB-140 also raises the device limit on a logical GPIB system from 15 to 26 devices. System developers can use the GPIB-140 to control remote printers or plotters as if they were next to the computer, isolate devices located in noisy or hazardous environments or control factory floor tests from a remote office.

For further information on the GPIB-140, contact National Instruments Australia, PO Box 466, Ringwood, Vic 3134. Phone (03) 9879 9422 or fax (03) 9879 9179.

SPEAKER KITS AND PARTS

Kits and drivers from vifa *Peerless and* DYNAUDIO®

Vifa Speaker Drivers:	Was	Now
D19AD-05-06 3/4" metal dome tweeter	$88	$39
D20TD-05-06 3/4" fabric dome tweeter	$66	$39
D25TF-55-06 1" soft dome tweeter	$74	$36
D26TG-35-06 1" double chamber tweeter	$114	$39
H25TG-35-06 1" dome horn tweeter	$114	$46
H26TG-35-06 1" fabric dome horn tweeter	$119	$67
M10MD-39-08 4" coated cone midrange	$99	$55
C13MH-09-08 5" coated cone midrange	$114	$49
D75MX-31-08 3" soft dome midrange	$129	$99
P17WG-00-08 6.5" polycone woofer	$128	$69
C20WG-18-08 8" woofer, coated cone	$129	$79
P21WO-00-08 8" polycone woofer, cast	$188	$138
Vifa Speaker Kits (cabinets not supplied)	**Was**	**Now**
SAX-50 2-way, 50 Watts, with front panel	$349	$220 pr
SAX-130 3-way, 130 Watts, with front panel	$1499	$799 pr
SW-1 Twin P25WO-00-08 subwoofer kit	$449	$299 ea
SW-2 Twin C20WG-18-08 subwoofer kit	$299	$199 ea

Peerless Speaker Drivers:	Was	Now
811582 1" soft dome tweeter	$45	$26
811827 1" Wide Angle soft dome tweeter	$69	$36
821214 2" High quality dome midrange	$139	$75
831663 8" polycone woofer	$99	$49
831680 6.5" High quality polycone woofer	$148	$69
831701 8" High quality polycone woofer	$179	$89
831531 10" polycone woofer	$169	$89
831676 10" High quality paper cone woofer	$249	$99
Peerless Speaker Kits (cabs not supplied)	**Was**	**Now**
PSK 60/2 2-Way, 6.5" woofer 60 Watts	$399	$199 pr
PSK 100/3 3-way twin 8" woofers 100 Watts	$749	$349 pr
Six new Dynaudio Speaker Kits (cabinets not supplied)		
Focus 2-way 17W-75 woofer, D28 tweeter, bookshelf		$1425 pr
Sirius 2-way 17W-75 woofer, D28 tweeter, floorstand.		$1795 pr
Aries 2-way 8" Esotec woofer. Floorstanding		$1995 pr
Gemini 2-way twin 15W-75 woofers, stand-mount		$2175 pr
Xennon-3 3-way superb florstanding speaker		$2650 pr
Finale 4-way large floorstanding - the ultimate kit		$4475 pr

Call or fax for free info pack on all our speaker kits, crossovers, inductors, Solen and Bennic capacitors, flared ports, terminals and other speaker parts. Or send $10 cheque, money order or fax with credit card details for full engineering dats sheets on over 60 speaker drivers from VIFA, PEERLESS AND DYNAUDIO. Bulk buyers: ask for quote. We are the cheapest in the country!

HOW TO ORDER:

- ***Phone order*** with your Bankcard, Mastercard or Visa.
- ***Fax or post*** your order with your credit card details - or ***Post*** a money order or bank cheque.
- **Delivery charge:** $10 per order Australia wide. Please allow one week for delivery.
- Some items are limited - stock available only until sold. ***Order now!***

SCAN AUDIO PTY LTD, P.O. BOX 242 HAWTHORN VIC 3122
PHONE: 03-9429 2199 FAX: 03-9429 9309

Genius cordless infrared mouse

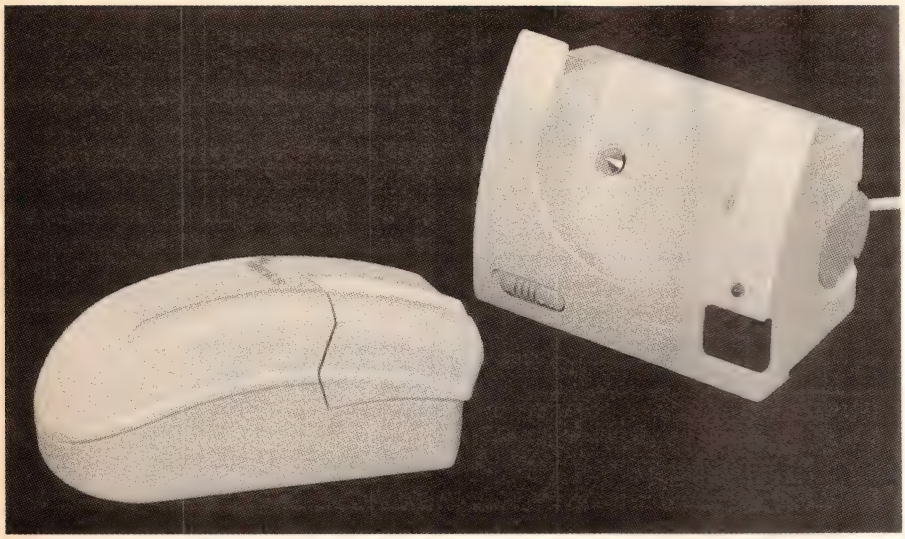
Recently, we had the opportunity to use the new, battery-operated, Genius cordless HiMouse. We found it to perform well, just like a mouse should. It is slightly thicker than a Microsoft mouse, tending to lift the palm of the hand slightly and thus reducing the friction with the desk. While I preferred it, this is very subjective, as another staff member preferred the feel of the lower profile normal unit.

The HiMouse comes in two parts, the cordless mouse and its cradle. The cradle has a lead which connects to the serial port, two rechargeable batteries, an infrared window and a slide switch to select between Microsoft and Mouse Systems modes.

When the mouse is not being used it is slipped into the cradle and has its battery recharged by those in the cradle, these being charged all the time the computer is turned on.

The HiMouse is a 3-button unit with software provision to exchange the left and right button functions for left handers. The contoured top makes it easy to locate the three buttons.

Installation was smooth and trouble-free, taking only a matter of minutes. The carton contains both 3.5-inch and 5.25-inch discs, to suit any model PC. The control panel, which can be made memory resident (to be called up at any time) or loaded from



DOS, allows users to set the mouse sensitivity and acceleration to suit their individual applications.

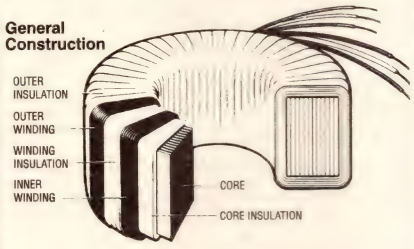
As well as the mouse software, a disc with a copy of Paintbrush IV, version 2, is included. While we did not use this program, the user's guide seems quite comprehensive, giving detailed steps on how to produce your own "work of art".

Our only complaint concerns the battery in the mouse. Several times during the test period it went flat and while it only took a few seconds to swap it with one in the cradle, it could be a source of annoyance. In addition, the batteries are sealed in a special plastic holder and any HiMouse owner would be totally dependent on the supplier for spares.

However, if you like the extra freedom of cordless operation, without the cord pulling the mouse in one direction, the Genius HiMouse is a boon. It has quite good operating range and it is not at all critical as far as having to be pointed at the infrared receiver in the cradle. In fact, we found you could point the HiMouse away at 90° to the direction of the receiver and it was still quite reliable. Many people will like it a lot.

Our sample Genius HiMouse came from Rod Irving Electronics and, at the time of writing, was priced at $79. Check with any Rod Irving Electronics store for the current price. (R.J.W.)

TOROIDAL POWER TRANSFORMERS



Manufactured in Australia
Comprehensive data available
Harbuch Electronics Pty Ltd
9/40 Leighton Pl. HORNSBY 2077
Ph (02) 476-5854 Fx (02) 476-3231

Audio Lab **R.S.K. Electronics Pty. Ltd.**

Complete Audio Lab kit with PCBs, 1% resistors, PTH screened PCBs, IC sockets, boot Eprom, screen printed case, 8K RAM, 8031 processor and all ICs.

Includes calibration and Audio Lab V5.1 software $330 inc. tax.

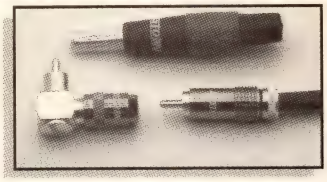
10 VAC 1A plugpack plus socket $18. Processor test kit $15.
2-Metre serial cable $9. Freight $9.

Fully assembled & calibrated complete with plugpack (1-year warranty) $450

5 Ludwig Place, Duncraig, Perth WA 6023 Phone (09) 448 3787

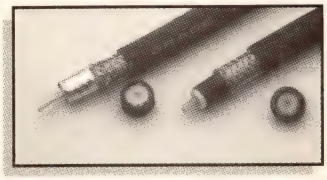
NEOTECH

CONNECTORS



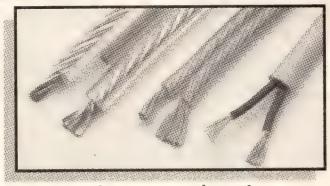
- Highest quality metal body with teflon insulation
- 24K gold plated pins, solder and screw terminations
- Improved "split" pin
- Locking RCA plugs, right angle types also available
- Accepts cables with 6mm to 9mm diameters

INTERCONNECT CABLE



- Perfect imaging
- 99% pure OFC copper conductors for improved signal transfer characteristics
- Super flexible and easy stripping PVC jacket
- All models are double shielded with either Mylar or Carbon conductive PVC
- Ultra low capacitance
- Rejects EMI and RFI noises

SPEAKER CABLE

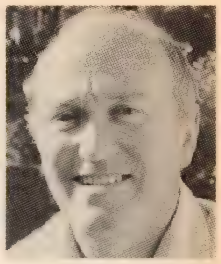


- Dynamic reproduction
- 99% pure OFC copper conductors for improved signal transfers
- Multiple configurations: round multicore, flat multi & standard figure "8" style

Exclusively Imported and distributed by
AVICO ELECTRONIC PTY LTD
PH: (02) 624-7977, FAX: (02) 624-7143
Trade Enquiries Only

NEOTECH AVAILABLE EXCLUSIVELY AT AUTHORISED NEOTECH HI FI DEALERS

VINTAGE RADIO



By JOHN HILL

Vibrators – a slice of history

Although crude by current standards, the vibrator made battery-operated receivers a lot more convenient to run. By using a vibrator, an expensive high-voltage "B" battery for the HT supply was no longer required.

In the early days of my vintage radio collecting I bought quite a number of receivers from George, a local secondhand dealer. George had made a special effort to round up all the old radio sets he had, searching his shop and storage sheds at home to come up with what, to the uninitiated, looked like the greatest pile of junk you could possibly imagine. It's not every day a dealer attempts to unload such a heap of "rubbish", or finds someone who actually wants to buy it.

However, George was always a reasonable man and he knew the difference between a collectible old radio and one that was only suitable for spare parts.

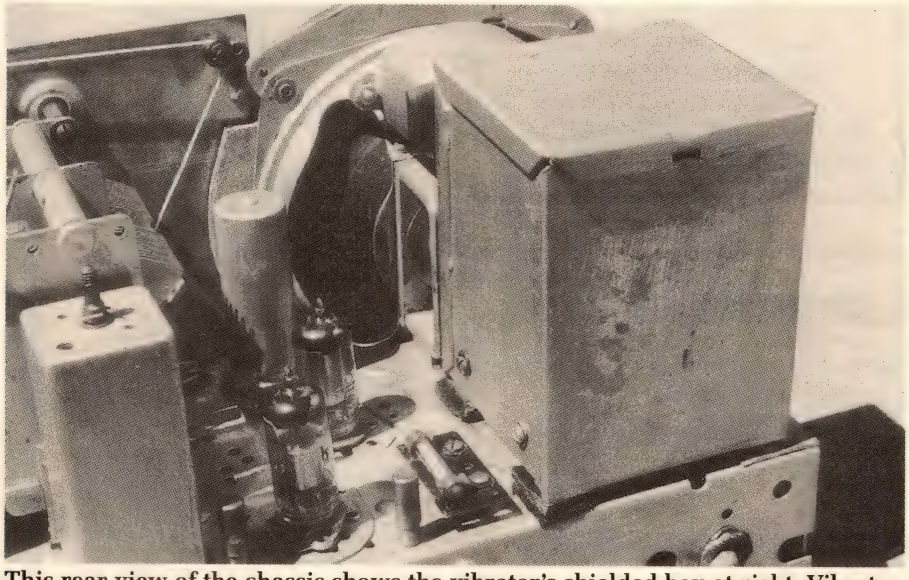
To cut a long story short, I took the lot and they averaged out at about $4 each. Most were stripped for spares but not all of them. There was this particularly neat little Radiola mantel of late 1940s vintage. It had an attractive bakelite cabinet and I was determined that it would be restored.

When I finally found time to inspect the little AWA it wasn't quite what I thought it was. Expecting to see a 240V receiver inside the cabinet, I was disappointed to find alligator clips dangling on the end of the power cord. It was a 4-valve vibrator set and, at that stage of my radio collecting career, it was a mystery to me. The vibrator Radiola was the first receiver of that type I had encountered.

After some book research, I had a better idea of what it was all about. The small AWA receiver was unusual as far as vibrator radios went because it was a 4V model as distinct from the more common 6V and 32V types.

A 4V supply is nowhere near as convenient as 6V and, in order to operate the Radiola, a 6V motor cycle battery was used in conjunction with a 2Ω wirewound resistor to give the required 4V. With almost no repairs, apart from a valve replacement, the old battery receiver was working once again and it seemed to be functioning fairly well.

About 20 operating hours later everything went quiet, although the vibrator was still buzzing away merrily. It was then that I started to lose interest in vibrator radios and when a 240V chassis came along, the little Radiola became a mains-powered model.

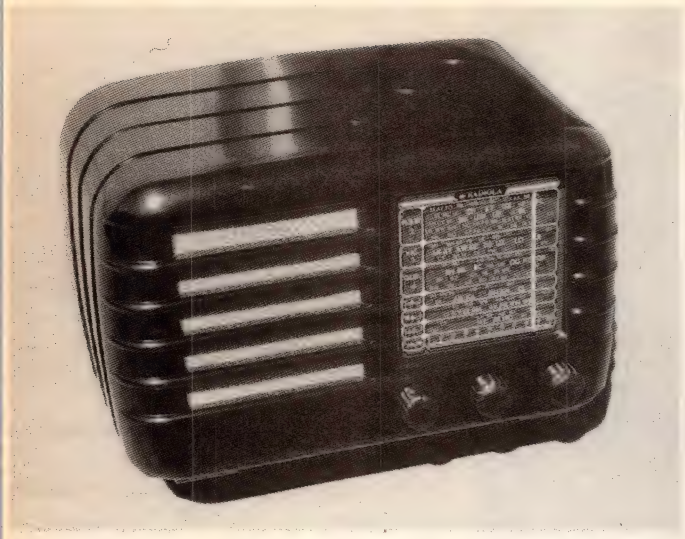


This rear view of the chassis shows the vibrator's shielded box at right. Vibrator power supplies require extensive shielding to prevent objectionable hum and RF interference.

A clever invention

By modern standards, a vibrator is a fairly crude device no matter how you look at it. Yet, in its day, it was a clever invention that made battery receivers a lot easier to live with. The vibrator, or vibrator cartridge, is a plug-in device, somewhat similar to a valve and made that way for much the same reason; it had a limited life and was expendable. It even used a standard valve socket, different types using 4-pin, 6-pin and 7-pin sockets.

With a vibrator, it was possible to make a radio power supply which required only one battery – usually a 6V battery, similar in size to a car battery, but designed for vibrator service. Compared to a straight battery



This Radiola model was a popular radio receiver in the early post-war years. It was available in both mains-operated and battery/vibrator operated versions (vibrator version shown).

A new 4V vibrator unit to suit the Radiola was unearthed in the author's miscellaneous parts cupboard. Vibrators of this type would be rare items today as they went out of use with the advent of the transistor radio.

receiver with 135V of dry cell "B" batteries, a vibrator set was a lot cheaper and more convenient to run, if one had the means to charge the battery.

A vibrator radio uses the one power source for the valve filaments and the high tension. But everyone knows that DC cannot be transformed, so where does the high tension come from? Well, that's where the vibrator comes in!

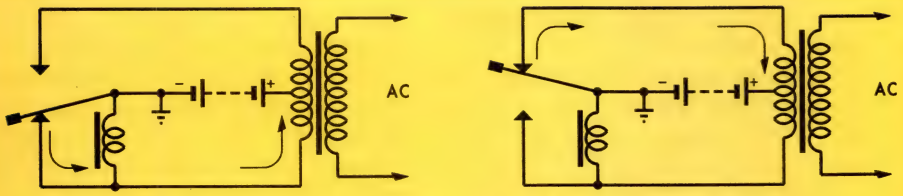
The vibrator's task is to change the low DC voltage into low voltage AC, in the form of a square wave at approximately 100Hz. This is done by using two sets of electrical contacts mounted each side of a vibrating reed. The vibrating part is similar in construction and operation to an electric buzzer or bell.

The vibrator contacts switch the DC voltage alternately between opposite ends of a centre tapped transformer, so that the current flows alternately in opposite directions through the primary – see Fig.1. But while such a system does produce high AC voltages in the transformer secondary, there are disadvantages.

The first problem is that because a supply generated in this way is basically a square wave, with spikes and other irregularities, plus inevitable sparking at the contacts, the system produces an incredible amount of radio frequency interference, referred to as "vibrator hash". Numerous RF chokes and capacitors need to be employed to help suppress (but not entirely eliminate) this interference. In addition, the entire vibrator power supply must be shielded all the way from the battery clips to the high tension output.

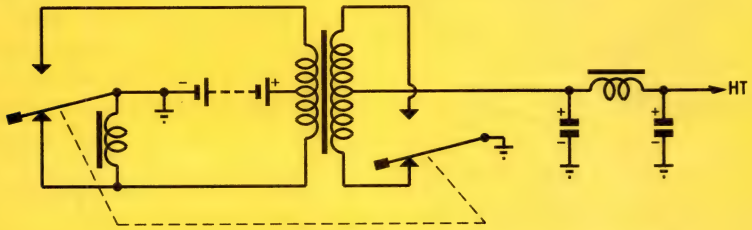
After transforming the switched DC to a higher voltage, it must then be rectified and effectively filtered to smooth DC before it can be used as a hum-free high tension voltage. Rectification of the high tension voltage can be done in several ways.

One way is to use a rectifier valve as would normally be used in a mains-operated receiver. The type of vibrator that uses a separate rectifier has two sets of switching contacts and is known as a non-synchronous vibrator.



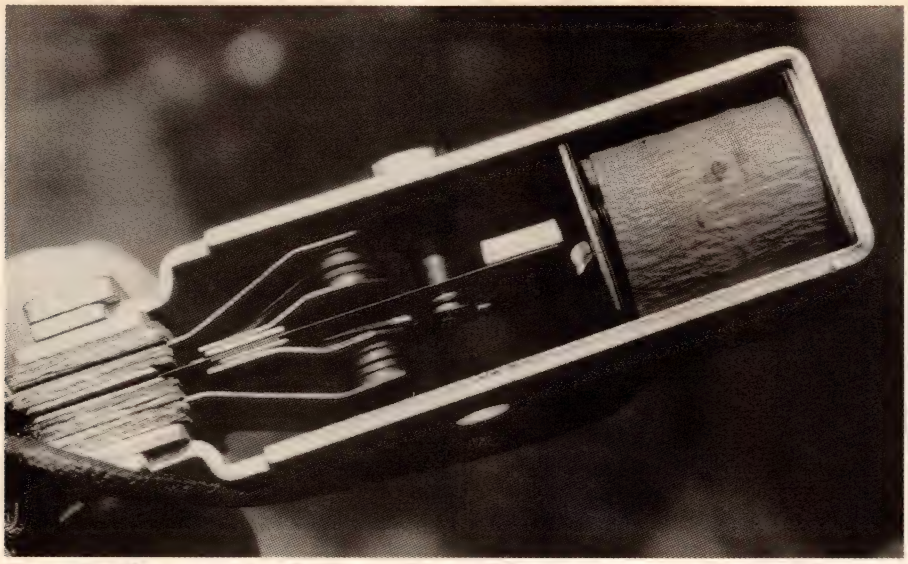
NON-SYNCHRONOUS VIBRATOR
REED CONTACTS NOT SHOWN

Fig.1: basic scheme for a non-synchronous vibrator. The vibrator contacts switch the DC voltage alternately between opposite ends of a centre-tapped transformer, so that the current flows alternately in opposite directions through the primary. The resulting AC output was then fed to a rectifier.



SYNCHRONOUS VIBRATOR
RF INTERFERENCE SUPPRESSION COMPONENTS NOT SHOWN

Fig.2: the synchronous vibrator arrangement. This type of vibrator employed a second set of contacts which were used to mechanically rectify the high tension current in conjunction with a centre-tapped transformer secondary.



Removing the cover reveals the workings of this synchronous vibrator. The solenoid unit (top) controls the vibrating reed (centre) which carries two sets of switching contacts on either side.

The non-synchronous vibrator was usually used in valve car radios, together with an ordinary AC-type rectifier valve. In car radios, power consumption was of little consequence and they normally had AC-type valves throughout.

Domestic vibrator radios were usually more economical in their operation and used mostly battery valves and a synchronous vibrator which has two additional sets of contacts inside it. These extra contacts are used to mechanically rectify the high tension current in conjunction with a centre tapped transformer secondary without the need for a rectifier valve – see Fig.2. This process produces a very lumpy DC voltage with a considerable amount of hash and needs very effective filtering.

Because of inefficiencies – partly in the vibrator cartridge and partly in the transformer – there were losses in the system. Also, the vibrator cartridges had a limited life. Even so, the replacement of the odd vibrator unit must have been a considerably lesser expense than the huge cost of dry cell "B" batteries.

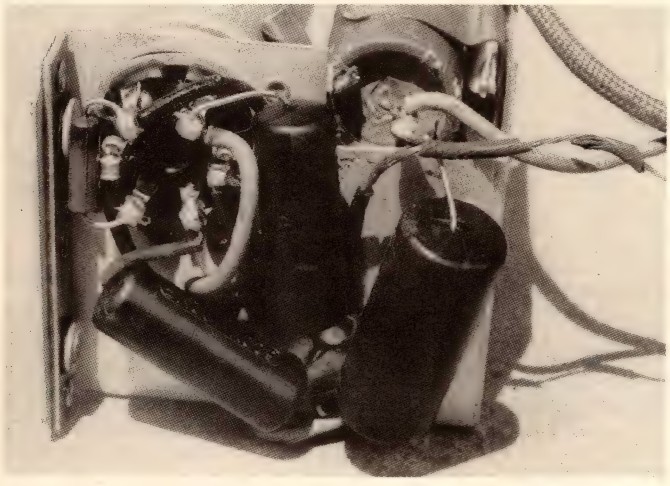
Cleaning the contacts

One of the problems restorers face regarding vibrator receivers is the lack of replacement vibrator units. It has been a long time since these things were used and they had relatively short life spans.

However, most vibrator units can be dismantled by removing a circlip and unsoldering a metal tab. Once inside, it is not difficult to clean the contact points with a fine grade of wet and dry paper followed by a piece of clean white paper to remove any dust or abrasive particles that may be trapped in between.

All contact gaps are adjustable either by screw thread or by bending. All contacts should be open when the vibrator reed is at rest except the contact that operates the reed. Point gap doesn't appear to be critical but wide variations may affect the high tension voltage. In the case of a synchronous vibrator, the gaps should be staggered so that the primary contacts close before and open after the secondary contacts. This helps to lessen the RF interference.

Not all vibrators can be serviced in such a convenient manner as some were made with similar construction techniques to that of metal valves. With this type, the vibrator contacts work in a vacuum or an inert gas. As there is no air present, the arcing at the contact points cannot form oxides with the contact material. Hence, these vacuum or gas type vibrators have a substantially longer life and higher current rating, although they are throwaway items when they stop working.



Removing the vibrator assembly from its shielded box revealed a defective electrolytic capacitor and a number of paper capacitors, all of which needed replacing.

The old Radiola

Recently, I decided to get my old Radiola vibrator radio working again, mainly because I had acquired a spare cabinet for that particular model. And as I have never written anything about vibrators in the past, it seemed like the right time to do so.

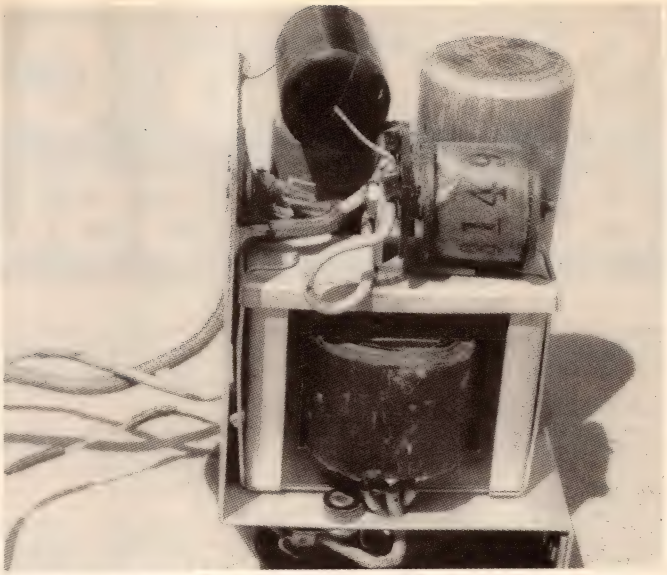
Restoring the little Radiola was no different to restoring any other receiver and the usual replacement of paper and electrolytic capacitors was a good starting point. There are two large 400µF 12V electros in the circuit and these were practically useless and needed replacing.

At that stage, the receiver was working again but had a very objectionable hum in it. As there was only one high voltage electrolytic mounted on the chassis, it appeared that the other was possibly housed in the vibrator box.

On removing the vibrator assembly (which is built on it own small chassis) from its shielded compartment, the elusive electrolytic was found and replaced. It was totally ineffective and had no capacitance whatsoever.

The removal of the vibrator chassis revealed another four paper capacitors that were previously hidden. They too were replaced. Obviously, proper restoration cannot be done to a vibrator radio unless the vibrator and its

The vibrator assembly in the old Radiola is built on its own chassis. The vibrator unit is at left, with the original faulty electrolytic capacitor immediately to its right. What looks like a paper capacitor at the top of the assembly is actually a sealed RF choke.



This view shows the vibrator assembly from the opposite side to the previous photo. The lower portion is occupied by the vibrator transformer. It is reasonably compact in size due to the fact that it only produces a high tension of 90V.

accompanying circuitry are removed and serviced accordingly.

Cleaning the vibrator contacts was straightforward and they were in excellent condition. As an added bonus, I found in my parts cupboard a new, still in its original packet, 4V vibrator bearing the same serial number as the one in the receiver.

The little Radiola is perhaps one of the last few domestic vibrator radios made. All the other vibrator sets I have encountered have been much older. Its valve line up is: 1R5, 1T4, 1S5 and 3V4. This is in distinct contrast to most vibrator receivers which seem to be 1930s models using 2V valves and 6V vibrators. The Radiola is the only vibrator radio I have seen with 1.4V valves and a 4V supply.

No doubt there are others but they are relatively uncommon in my area.

To finish off the restoration, a new dial cord was fitted and the noisy volume control cleaned. An alignment improved the set's performance considerably.

On the subject of performance, the Radiola's quarter watt output and small 5-inch (125mm) loudspeaker does not rate it in the "ghetto blaster" category. Now I remember why I was keen to install a 240V chassis into the AWA's original cabinet.

Even so, the little 4-valver performs surprisingly well and makes the most of its quarter watt output. It is a very sensitive receiver and is capable of picking up many interstate stations in daylight hours.

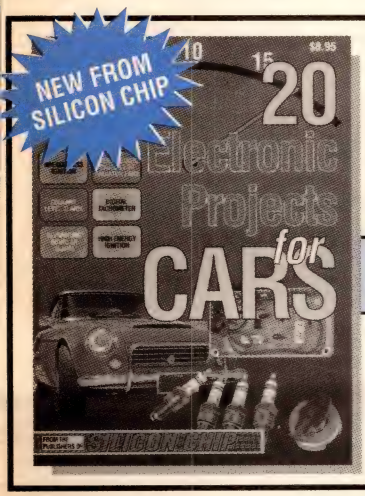
Finally, if you are unconcerned by originality, vibrator problems can be overcome simply by feeding an appropriate low-level AC voltage straight into the primary of the vibrator transformer. This does away with both the vibrator and its accompanying hash. And if you are clever enough, no doubt there is a solid state alternative to the old vibrator.

However, having a vibrator radio working in its original form is a much more satisfying restoration. **SC**

VINTAGE RADIO SWAP MEET

22nd October 1995
Glenroy Tech School Hall
Melbourne
Admission: $3

Enquiries: (054) 49 3207



20 Electronic Projects For Cars

On sale now at selected newsagents

Or order your copy from Silicon Chip. Price: $8.95 (plus $3 for postage). Order by phoning (02) 979 5644 & quoting your credit card number; or fax the details to (02) 979 6503; or mail your order with cheque or credit card details to Silicon Chip Publications, PO Box 139, Collaroy, NSW 2097.

Silicon Chip BACK ISSUES

September 1988: Hands-Free Speakerphone; Electronic Fish Bite Detector; High Performance AC Millivoltmeter, Pt.2; Build The Vader Voice.

April 1989: Auxiliary Brake Light Flasher; What You Need to Know About Capacitors; 32-Band Graphic Equaliser, Pt.2; LED Message Board, Pt.2.

May 1989: Build A Synthesised Tom-Tom; Biofeedback Monitor For Your PC; Simple Stub Filter For Suppressing TV Interference; LED Message Board, Pt.3; All About Electrolytic Capacitors.

July 1989: Exhaust Gas Monitor (Uses TGS812 Gas Sensor); Extension For The Touch-Lamp Dimmer; Experimental Mains Hum Sniffers; Compact Ultrasonic Car Alarm.

September 1989: 2-Chip Portable AM Stereo Radio (Uses MC13024 and TX7376P) Pt.1; High Or Low Fluid Level Detector; Studio Series 20-Band Stereo Equaliser, Pt.2; Auto-Zero Module for Audio Amplifiers (Uses LMC669).

October 1989: FM Radio Intercom For Motorbikes Pt.1; GaAsFet Preamplifier For Amateur TV; 1Mb Printer Buffer; 2-Chip Portable AM Stereo Radio, Pt.2; Installing A Hard Disc In The PC.

November 1989: Radfax Decoder For Your PC (Displays Fax, RTTY & Morse); FM Radio Intercom For Motorbikes, Pt.2; 2-Chip Portable AM Stereo Radio, Pt.3; Floppy Disc Drive Formats & Options; The Pilbara Iron Ore Railways.

December 1989: Digital Voice Board (Records Up To Four Separate Messages); UHF Remote Switch; Balanced Input & Output Stages; Data For The LM831 Low Voltage Amplifier IC; Index to Volume 2.

January 1990: High Quality Sine/Square Oscillator; Service Tips For Your VCR; Speeding Up Your PC; Phone Patch For Radio Amateurs; Active Antenna Kit; Speed Controller For Ceiling Fans; Designing UHF Transmitter Stages.

February 1990: 16-Channel Mixing Desk; High Quality Audio Oscillator, Pt.2; The Incredible Hot Canaries; Random Wire Antenna Tuner For 6 Metres; Phone Patch For Radio Amateurs, Pt.2.

March 1990: 6/12V Charger For Sealed Lead-Acid Batteries; Delay Unit For Automatic Antennas; Workout Timer For Aerobics Classes; 16-Channel Mixing Desk, Pt.2; Using The UC3906 SLA Battery Charger IC.

April 1990: Dual Tracking ±50V Power Supply; Voice-Operated Switch (VOX) With Delayed Audio; 16-Channel Mixing Desk, Pt.3; Active CW Filter For Weak Signal Reception; How To Find Vintage Receivers From The 1920s.

June 1990: Multi-Sector Home Burglar Alarm; Low-Noise Universal Stereo Preamplifier; Load Protection Switch For Power Supplies; A Speed Alarm For Your Car; Fitting A Fax Card To A Computer.

July 1990: Digital Sine/Square Generator, Pt.1 (Covers 0-500kHz); Burglar Alarm Keypad & Combination Lock; Simple Electronic Die; Low-Cost Dual Power Supply; Inside A Coal Burning Power Station.

August 1990: High Stability UHF Remote Transmitter; Universal Safety Timer For Mains Appliances (9 Minutes); Horace The Electronic Cricket; Digital Sine/Square Wave Generator, Pt.2.

September 1990: Remote Control Extender For VCRs; Power Supply For Burglar Alarms; Low-Cost 3-Digit Counter Module; Simple Shortwave Converter For The 2-Metre Band.

October 1990: Low-Cost Siren For Burglar Alarms; Dimming Controls For The Discolight; Surfsound Simulator; DC Offset For DMMs; The Dangers of Polychlorinated Biphenyls; Using The NE602 In Home-Brew Converter Circuits.

November 1990: How To Connect Two TV Sets To One VCR; A Really Snazzy Egg Timer; Low-Cost Model Train Controller; Battery Powered Laser Pointer; 1.5V To 9V DC Converter; Introduction To Digital Electronics; Simple 6-Metre Amateur Transmitter.

December 1990: DC-DC Converter For Car Amplifiers; The Big Escape – A Game Of Skill; Wiper Pulser For Rear Windows; A 4-Digit Combination Lock; 5W Power Amplifier For The 6-Metre Amateur Transmitter; Index To Volume 3.

January 1991: Fast Charger For Nicad Batteries, Pt.1; Have Fun With The Fruit Machine; Two-Tone Alarm Module; LCD Readout For The Capacitance Meter; How Quartz Crystals Work; The Dangers When Servicing Microwave Ovens.

February 1991: Synthesised Stereo AM Tuner, Pt.1; Three Inverters For Fluorescent Lights; Low-Cost Sinewave Oscillator; Fast Charger For Nicad Batteries, Pt.2; How To Design Amplifier Output Stages

March 1991: Remote Controller For Garage Doors, Pt.1; Transistor Beta Tester Mk.2; A Synthesised AM Stereo Tuner, Pt.2; Multi-Purpose I/O Board For PC-Compatibles; Universal Wideband RF Preamplifier For Amateur Radio & TV.

April 1991: Steam Sound Simulator For Model Railroads; Remote Controller For Garage Doors, Pt.2; Simple 12/24V Light Chaser; Synthesised AM Stereo Tuner, Pt.3; A Practical Approach To Amplifier Design, Pt.2.

May 1991: 13.5V 25A Power Supply For Transceivers; Stereo Audio Expander; Fluorescent Light Simulator For Model Railways; How To Install Multiple TV Outlets, Pt.1.

June 1991: A Corner Reflector Antenna For UHF TV; 4-Channel Lighting Desk, Pt.1; 13.5V 25A Power Supply For Transceivers; Active Filter For CW Reception; Tuning In To Satellite TV, Pt.1.

July 1991: Battery Discharge Pacer For Electric Vehicles; Loudspeaker Protector For Stereo Amplifiers; 4-Channel

ORDER FORM

Buy 10 or more & get 10% discount

Please send me a back issue for:

- ❑ July 1989
- ❑ January 1990
- ❑ July 1990
- ❑ December 1990
- ❑ May 1991
- ❑ October 1991
- ❑ March 1992
- ❑ August 1992
- ❑ March 1993
- ❑ August 1993
- ❑ January 1994
- ❑ June 1994
- ❑ November 1994
- ❑ April 1995
- ❑ September 1995
- ❑ September 1989
- ❑ February 1990
- ❑ August 1990
- ❑ January 1991
- ❑ June 1991
- ❑ November 1991
- ❑ April 1992
- ❑ September 1992
- ❑ April 1993
- ❑ September 1993
- ❑ February 1994
- ❑ July 1994
- ❑ December 1994
- ❑ May 1995
- ❑ September 1988
- ❑ October 1989
- ❑ March 1990
- ❑ September 1990
- ❑ February 1991
- ❑ July 1991
- ❑ December 1991
- ❑ May 1992
- ❑ October 1992
- ❑ May 1993
- ❑ October 1993
- ❑ March 1994
- ❑ August 1994
- ❑ January 1995
- ❑ June 1995
- ❑ April 1989
- ❑ November 1989
- ❑ April 1990
- ❑ October 1990
- ❑ March 1991
- ❑ August 1991
- ❑ January 1992
- ❑ June 1992
- ❑ January 1993
- ❑ June 1993
- ❑ November 1993
- ❑ April 1994
- ❑ September 1994
- ❑ February 1995
- ❑ July 1995
- ❑ May 1989
- ❑ December 1989
- ❑ June 1990
- ❑ November 1990
- ❑ April 1991
- ❑ September 1991
- ❑ February 1992
- ❑ July 1992
- ❑ February 1993
- ❑ July 1993
- ❑ December 1993
- ❑ May 1994
- ❑ October 1994
- ❑ March 1995
- ❑ August 1995

Enclosed is my cheque/money order for $_____or please debit my: ❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | | |

Signature _____ Card expiry date_____ /_____

Name _____ Phone No (___) _____
PLEASE PRINT

Street _____

Suburb/town _____ Postcode _____

Note: all prices include post & packing

Australia (by return mail) $A7
NZ & PNG (airmail) $A7
Overseas (airmail) $A10

Detach and mail to:
Silicon Chip Publications, PO Box 139, Collaroy, NSW, Australia 2097.

Or call (02) 979 5644 & quote your credit card details or fax the details to (02) 979 6503.

Lighting Desk, Pt.2; How To Install Multiple TV Outlets, Pt.2; Tuning In To Satellite TV, Pt.2.

August 1991: Build A Digital Tachometer; Masthead Amplifier For TV & FM; PC Voice Recorder; Tuning In To Satellite TV, Pt.3; Step-By-Step Vintage Radio Repairs.

September 1991: Studio 3-55L 3-Way Loudspeaker System; Digital Altimeter For Gliders & Ultralights, Pt.1; The Basics Of A/D & D/A Conversion; Windows 3 Swapfiles, Program Groups & Icons.

October 1991: Build A Talking Voltmeter For Your PC, Pt.1; SteamSound Simulator For Model Railways Mk.II; Magnetic Field Strength Meter; Digital Altimeter For Gliders & Ultralights, Pt.2; Getting To Know The Windows PIF Editor.

November 1991: Colour TV Pattern Generator, Pt.1; Battery Charger For Solar Panels; Flashing Alarm Light For Cars; Digital Altimeter For Gliders & Ultralights, Pt.3; Build A Talking Voltmeter For Your PC, Pt.2.

December 1991: TV Transmitter For VCRs With UHF Modulators; Infrared Light Beam Relay; Solid-State Laser Pointer; Colour TV Pattern Generator, Pt.2; Index To Volume 4.

January 1992: 4-Channel Guitar Mixer; Adjustable 0-45V 8A Power Supply, Pt.1; Baby Room Monitor/FM Transmitter; Automatic Controller For Car Headlights; Experiments For Your Games Card; Restoring An AWA Radiolette.

February 1992: Compact Digital Voice Recorder; 50-Watt/Channel Stereo Power Amplifier; 12VDC/240VAC 40-Watt Inverter; Adjustable 0-45V 8A Power Supply, Pt.2; Designing A Speed Controller For Electric Models.

March 1992: TV Transmitter For VHF VCRs; Studio Twin Fifty Stereo Amplifier, Pt.1; Thermostatic Switch For Car Radiator Fans; Telephone Call Timer; Coping With Damaged Computer Directories; Valve Substitution In Vintage Radios.

April 1992: IR Remote Control For Model Railroads; Differential Input Buffer For CROs; Studio Twin Fifty Stereo Amplifier, Pt.2; Understanding Computer Memory; Aligning Vintage Radio Receivers, Pt.1.

May 1992: Build A Telephone Intercom; Low-Cost Electronic Doorbell; Battery Eliminator For Personal Players; Infrared Remote Control For Model Railroads, Pt.2; Aligning Vintage Radio Receivers, Pt.2.

June 1992: Multi-Station Headset Intercom, Pt.1; Video Switcher For Camcorders & VCRs; Infrared Remote Control For Model Railroads, Pt.3; 15-Watt 12-240V Inverter; A Look At Hard Disc Drives.

July 1992: Build A Nicad Battery Discharger; 8-Station Automatic Sprinkler Timer; Portable 12V SLA Battery Charger; Multi-Station Headset Intercom, Pt.2; Electronics Workbench For Home Or Laboratory.

August 1992: Build An Automatic SLA Battery Charger; Miniature 1.5V To 9V DC Converter; Dummy Load Box For Large Audio Amplifiers; Internal Combustion Engines For Model Aircraft; Troubleshooting Vintage Radio Receivers.

September 1992: Multi-Sector Home Burglar Alarm; Heavy-Duty 5A Drill speed Controller (see errata Nov. 1992); General-Purpose 3½-Digit LCD Panel Meter; Track Tester For Model Railroads; Build A Relative Field Strength Meter.

October 1992: 2kW 24VDC To 240VAC Sinewave Inverter; Multi-Sector Home Burglar Alarm, Pt.2; Mini Amplifier For Personal Stereos; Electronically Regulated Lead-Acid Battery Charger.

January 1993: Peerless PSK60/2 2-Way Hifi Loudspeakers; Flea-Power AM Radio Transmitter; High Intensity LED Flasher For Bicycles; 2kW 24VDC To 240VAC Sinewave Inverter, Pt.4; Speed Controller For Electric Models, Pt.3.

February 1993: Three Simple Projects For Model Railroads; A Low Fuel Indicator For Cars; Audio Level/VU Meter With LED Readout; Build An Electronic Cockroach; MAL-4 Microcontroller Board, Pt.3; 2kW 24VDC To 240VAC Sinewave Inverter, Pt.5.

March 1993: Build A Solar Charger For 12V Batteries; Alarm-Triggered Security Camera; Low-Cost Audio Mixer for Camcorders;A 24-Hour Sidereal Clock For Astronomers.

April 1993: Solar-Powered Electric Fence; Build An Audio Power Meter; Three-Function Home Weather Station; 12VDC To 70VDC Step-Up Voltage Converter; Digital Clock With Battery Back-Up.

May 1993: Nicad Cell Discharger; Build The Woofer Stopper; Remote Volume Control For Hifi Systems, Pt.1; Alphanumeric LCD Demonstration Board; The Microsoft Windows Sound System.

June 1993: Windows-Based Digital Logic Analyser, Pt.1; Build An AM Radio Trainer, Pt.1; Remote Control For The Woofer Stopper; Digital Voltmeter For Cars; Remote Volume Control For Hifi Systems, Pt.2

July 1993: Build a Single Chip Message Recorder; Light Beam Relay Extender; AM Radio Trainer, Pt.2; Windows Based Digital Logic Analyser; Pt.2; Quiz Game Adjudicator; Programming The Motorola 68HC705C8 Microcontroller – Lesson 1; Antenna Tuners – Why They Are Useful.

August 1993: Low-Cost Colour Video Fader; 60-LED Brake Light Array; A Microprocessor-Based Sidereal Clock; The Southern Cross Z80-Based Computer; A Look At Satellites & Their Orbits.

September 1993: Automatic Nicad Battery Charger/Discharger; Stereo Preamplifier With IR Remote Control, Pt.1; In-Circuit Transistor Tester; A +5V to ±15V DC Converter; Remote-Controlled Cockroach; Servicing An R/C Transmitter, Pt.1.

October 1993: Courtesy Light Switch-Off Timer For Cars; Wireless Microphone For Musicians; Stereo Preamplifier With IR Remote Control, Pt.2; Electronic Engine Management, Pt.1; Programming The Motorola 68HC705C8 Microcontroller – Lesson 2; Servicing An R/C Transmitter, Pt.2.

November 1993: Jumbo Digital Clock; High Efficiency Inverter For Fluorescent Tubes; Stereo Preamplifier With IR Remote Control, Pt.3; Siren Sound Generator; Electronic Engine Management, Pt.2; Experiments For Games Cards.

December 1993: Remote Controller For Garage Doors; Low-Voltage LED Stroboscope; Low-Cost 25W Amplifier Module; Build A 1-Chip Melody Generator; Electronic Engine Management, Pt.3; Index To Volume 6.

January 1994: 3A 40V Adjustable Power Supply; Switching Regulator For Solar Panels; Printer Status Indicator; Mini Drill Speed Controller; Stepper Motor Controller; Active Filter Design For Beginners; Electronic Engine Management, Pt.4.

February 1994: 90-Second Message Recorder; Compact & Efficient 12-240VAC 200W Inverter; Single Chip 0.5W Audio Amplifier; 3A 40V Adjustable Power Supply; Electronic Engine Management, Pt.5; Airbags – How They Work.

March 1994: Intelligent IR Remote Controller; Build A 50W Audio Amplifier Module; Level Crossing Detector For Model Railways; Voice Activated Switch For FM Microphones; Simple LED Chaser; Electronic Engine Management, Pt.6.

April 1994: Remote Control Extender For VCRs; Sound & Lights For Model Railway Level Crossings; Discrete Dual Supply Voltage Regulator; Low-Noise Universal Stereo Preamplifier; Build A Digital Water Tank Gauge; Electronic Engine Management, Pt.7.

May 1994: Fast Charger For Nicad Batteries; Induction Balance Metal Locator; Multi-Channel Infrared Remote Control; Dual Electronic Dice; Two Simple Servo Driver Circuits; Electronic Engine Management, Pt.8; Passive Rebroadcasting For TV Signals.

June 1994: 200W/350W Mosfet Amplifier Module; A Coolant Level Alarm For Your Car; An 80-Metre AM/CW Transmitter For Amateurs; Converting Phono Inputs To Line Inputs; A PC-Based Nicad Battery Monitor; Electronic Engine Management, Pt.9

July 1994: SmallTalk – a Tiny Voice Digitiser For The PC; Build A 4-Bay Bow-Tie UHF Antenna; PreChamp 2-Transistor Preamplifier; Steam Train Whistle & Diesel Horn Simulator; Portable 6V SLA Battery Charger; Electronic Engine Management, Pt.10.

August 1994: High-Power Dimmer For Incandescent Lights; Microprocessor-Controlled Morse Keyer; Dual Diversity Tuner For FM Microphones, Pt.1; Build a Nicad Zapper; Simple Crystal Checker; Electronic Engine Management, Pt.11.

September 1994: Automatic Discharger For Nicad Battery Packs; MiniVox Voice Operated Relay; Image Intensified Night Viewer; AM Radio For Aircraft Weather Beacons; Dual Diversity Tuner For FM Microphones, Pt.2; Electronic Engine Management, Pt.12.

October 1994: Dolby Surround Sound – How It Works; Dual Rail Variable Power Supply (±1.25V to ±15V); Talking Headlight Reminder; Electronic Ballast For Fluorescent Lights; Temperature Controlled Soldering Station; Electronic Engine Management, Pt.13.

November 1994: Dry Cell Battery Rejuvenator; A Novel Alphanumeric Clock; 80-Metre DSB Amateur Transmitter; Twin-Cell Nicad Discharger (See May 1993); Anti-Lock Braking Systems; How To Plot Patterns Direct To PC Boards.

December 1994: Dolby Pro-Logic Surround Sound Decoder, Pt.1; Easy-To-Build Car Burglar Alarm; Three-Spot Low Distortion Sinewave Oscillator; Clifford – A Pesky Electronic Cricket; Cruise Control – How It Works; Remote Control System for Models, Pt.1; Index to Vol.7.

January 1995: Build A Sun Tracker For Solar Panels; Battery Saver For Torches; Dolby Pro-Logic Surround Sound Decoder, Pt.2; Dual Channel UHF Remote Control; Stereo Microphone Preamplifier; The Latest Trends In Car Sound; Pt1.

February 1995: 50-Watt/Channel Stereo Amplifier Module; Digital Effects Unit For Musicians; 6-Channel Thermometer With LCD Readout; Wide Range Electrostatic Loudspeakers, Pt.1; Oil Change Timer For Cars; The Latest Trends In Car Sound; Pt2; Remote Control System For Models, Pt.2.

March 1995: 50W/Channel Stereo Amplifier, Pt.1; Subcarrier Decoder For FM Receivers; Wide Range Electrostatic Loudspeakers, Pt.2; IR Illuminator For CCD Cameras & Night Viewers; Remote Control System For Models, Pt.3; Simple CW Filter.

April 1995: Build An FM Radio Trainer, Pt.1; Photographic Timer For Darkrooms; Balanced Microphone Preamplifier & Line Filter; 50W/Channel Stereo Amplifier, Pt.2; Wide Range Electrostatic Loudspeakers, Pt.3; 8-Channel Decoder For Radio Remote Control.

May 1995: Introduction To Satellite TV; CMOS Memory Settings – What To Do When the Battery On Your Motherboard Goes Flat; Mains Music Transmitter & Receiver; Guitar Headphone Amplifier For Practice Sessions; Build An FM Radio Trainer, Pt.2; Low Cost Transistor & Mosfet Tester For DMMs; 16-Channel Decoder For Radio Remote Control.

June 1995: Build A Satellite TV Receiver; Train Detector For Model Railways; A 1W Audio Amplifier Trainer; Low-Cost Video Security System; A Multi-Channel Radio Control Transmitter For Models, Pt.1; Build A $30 Digital Multimeter.

July 1995: Low-Power Electric Fence Controller; How To Run Two Trains On A Single Track (Plus Level Crossing Lights & Sound Effects); Setting Up A Satellite TV Ground Station; Build A Reliable Door Minder; Adding RAM To Your Computer; Philips' CDI-210 Interactive CD Player.

August 1995: Vifa JV-60 2-Way Bass Reflex Loudspeaker System; A Fuel Injector Monitor For Cars; Gain Controlled Microphone Preamp; The Audio Lab PC Controlled Test Instrument, Pt.1; The Mighty-Mite Powered Loudspeaker; An Easy Way To Identify IDE Hard Disc Drive Parameters.

September 1995: Build A Keypad Combination Lock; The Incredible Vader Voice; Railpower Mk.2 Walk-Around Throttle For Model Railways, Pt.1; Build A Jacob's Ladder Display; The Audio Lab PC Controlled Test Instrument, Pt.2; Automotive Ignition Timing, Pt.1; Running MemMaker & Avoiding Memory Conflicts.

PLEASE NOTE: November 1987 to August 1988, October 1988 to March 1989, June 1989, August 1989, May 1990, November 1992 and December 1992 are now sold out. All other issues are presently in stock. For readers wanting articles from sold-out issues, we can supply photostat copies (or tearsheets) at $7.00 per article (includes. p&p). When supplying photostat articles or back copies, we automatically supply any relevant notes & errata at no extra charge.

ASK SILICON CHIP

Got a technical problem? Can't understand a piece of jargon or some technical principle? Drop us a line and we'll answer your question. Write to: Ask Silicon Chip, PO Box 139, Collaroy Beach, NSW 2097.

Request for high quality class-A amplifier

I have just purchased your "Dolby Pro-Logic Surround Sound Decoder", as featured in the December 1994 & January 1995. Congratulations to you and all those involved in this project. It must have been very time consuming to develop.

I have also read your Publisher's Letter (July 1994) where you stated that valve amplifiers are "dead and buried". Well, that statement floored me and I've only just recovered. There is a publication called *Hi-Fi World* that bases its whole existence on valve amplifiers, particularly the single-ended types using 300Bs and 211s, etc. Some valve amplifiers sell for $34,500 each. They have silver wire wound output transformers, silver foil capacitors, etc, and they possess an openness and are sonically superior to any transistor amplifier ever built. Well, we have all read and heard this, and I have heard these single-ended mono-blocks and believe me they *do* sound good.

Well, that's fine and like you say, they are dead and buried, for the average audiophile like me and many others. But to complement your beautiful project, the Dolby Pro-Logic Surround Sound Decoder, could you see if there would be enough interest for you to design a single-ended class A transistor amplifier, having all those qualities that valve amplifiers possess.

This kit would not be cheap and why should it when European kits (valve) start at $4000. The capacitors, transistors and other vital parts would have to be sourced from all over the world, or would they? Perhaps there are manufacturers right here in Australia that could be interested in this project. Why is it that the "high end" components come from overseas? (R. L., Somerville, Vic)

• We stick to our contention that valve amplifiers are no longer relevant. You should understand that very high-priced amplifiers and other equipment have little or no performance edge over the best mass-produced equipment. In many cases, particularly where valves are used, they are inferior. Amplifiers costing $34,500 are designed merely to separate very rich ignorant people from their money.

Both Tortech Pty Ltd and Harbuch Electronics Pty Ltd, advertisers in our magazine, are able to wind high quality transformers to order. As far as we know, capacitors are no longer being made in Australia, so they all need to come from overseas. Our experience with high priced amplifier kits is that very few people can afford to build them. And most of those who can afford a high priced kit would rather go and buy the finished product.

Electric fence needs more bite

I recently bought the electric fence controller kit that was published in SILICON CHIP, July 1995. I assembled the kit, checked the values of all components and it worked first time. However, I was rather disappointed with the zap that the unit put out.

Compared to a cheap commercial unit our neighbour has, it is only a tingle and as soon as rain fell, it would not work but the neighbours' unit on my line worked fine in the wet. My unit has not got the zap I expected it to have and the horses appear unperturbed by it. So I do not think it is suitable for controlling livestock.

I have made a couple of modifications to the circuit which make it work a lot better and give a similar zap to the cheap commercial unit. I added one 2.2Ω resistor and one 1000µF capacitor in the positive supply to the coil and a diode between the coil and the output transistor. My scope is only an old 10MHz unit and it is difficult to measure the fast rise time and the voltages involved correctly. My main questions and reason for writing is to

Locomotive compressor sound generator

Could you come up with another train sound effects circuit? Train sound effects have just about been fully covered you would think. Not so! One that hasn't been done anywhere to my knowledge is the resonating, intermittent, boom-boom noise of the exhaust of the Westinghouse air compressor on steam locos such as the C36. The sound has a peculiar deep resonating quality and is quite loud and distinctive. It is typical of what one would expect when a large pulse of air under high pressure is released into a large hollow steel vessel.

I would have a go at it myself with a simple oscillator circuit but the resonating boom quality (fairly low frequency) is something I don't know how to create. In fact, it ought to be relatively easy – certainly much easier than simulating the throb and superimposed whine of a diesel, and that has been done a number of times to my knowledge. (P. D., Orange, NSW).

• We think it would be very difficult to simulate the sound of a locomotive's air compressor directly with electronic circuitry. To produce a really authentic sound, it would be better to record the sounds of the real locomotive and then store them in one of the solid state message recorder chips. You could use the 16-second chip described in the July 1993 issue or the 90 second version described in the February 1994 issue. We do have back issues available at $7 each, including postage.

find out if the modifications made would be outside the standards set down and whether they may be dangerous. (B. I., Riverside, Tas).

• The Australian Standards require that the output voltage must not exceed 5kV when the high tension output is loaded via a 1MΩ resistor to ground. We set the duration of charge for the ignition coil so that it did not produce greater than 5kV. Your modifications may have altered the controller so that it produces a higher voltage.

We are not sure what effect the diode in series with the coil driving transistor has, except to reduce the coil current due to its voltage drop. The 1000µF capacitor and 2.2Ω resistor will have the effect of increasing the coil current during charging to result in higher output. The same effect could be achieved by reducing the value of the 6.8Ω resistor in series with the coil.

Check the voltage swing from the coil with a 1MΩ resistive load. This will need to withstand at least 5kV and since 0.5W resistors normally have a DC rating of only 350V, you will need a series string of at least 15 resistors. Even with 15 resistors you may have problems because the fast-rising voltage pulse may break over the resistors.

How to produce a black screen

I constructed the colour TV pattern generator (SILICON CHIP, November & December 1991) some time ago and found it works exceptionally well but I wish to modify the unit to generate a black screen. However, I am unsure how to do this properly.

I understand that IC15 (74HC193) will generate black when all the Q outputs are grounded and the cathodes of D5, D6 & D7 go low; the clock signal to IC15 is thus disabled and the black signal from IC16 continues until the next blanking period. Does this mean that the blanking signal must be interrupted? (D. B., Redland Bay, Qld).

• A black screen can be obtained by selecting the red raster pattern and tying pin 1 of IC15 low via a switch. This will set all colour inputs to IC16 (red, green and blue) low for a black signal. The colour burst and sync pulses will be taken care of with the sync and blank inputs on IC16.

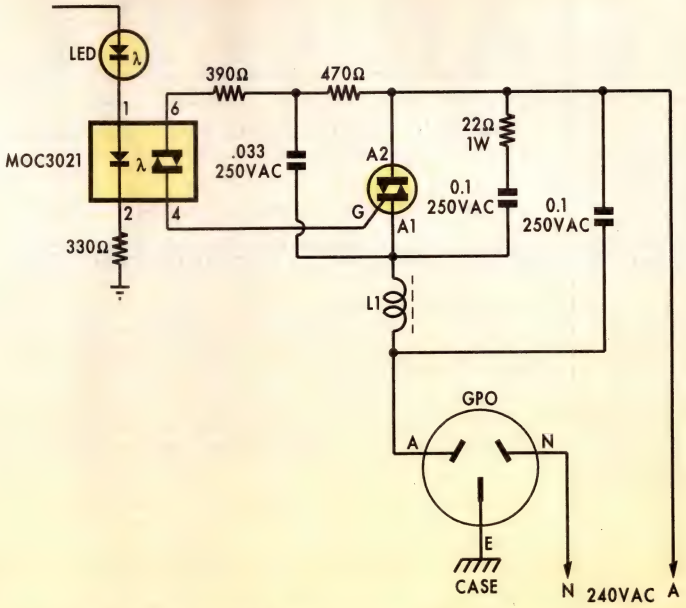


Fig.1: this circuit shows the additional snubber components which should be added to the Discolight to ensure reliable commutation of the Triac and the optocoupler.

Discolight with neon lighting

I have built your Discolight project as described in the July & August 1988 issues. I am using it as a chaser to drive neon lighting transformers. Trouble is, the Triacs appear to be getting very hot and two of the suppression inductors have definite signs of overheating; ie, they are discoloured.

The neon transformers have a rating of 10kV at 25mA. Since I am using the project only in chaser mode, whereby it operates with zero voltage switching, I cannot see why there should be any problem with power dissipation in the Triacs. Can you offer any clues as to what the trouble may be? (G. S., Bendigo, Vic).

• Those neon transformers represent a very severe inductive load which the Discolight was never intended to drive. For reliable commutation (ie, switching off) of inductive loads, Triacs must be fitted with snubber networks. This is an RC network connected between the A1 & A2 terminals to effectively make the load more resistive rather than inductive.

We used a snubber network connected across a Triac in the High Power Dimmer featured in the August 1994 issue of SILICON CHIP. This network consisted of a 22Ω 1W resistor in series with a 0.1µF 250VAC capacitor. You would need to connect this snubber network across each of the four Triacs in the Discolight. Each MOC3021 optocoupler requires a snubber too. The accompanying diagram shows a .033µF capacitor in association with 470Ω and 390Ω resistors.

Apart from the snubber networks, it is usual practice to connect an incandescent lamp (40W minimum) to each channel to provide a minimum resistive load for the Triacs.

However, having said all that, the fact that the interference suppression inductors are overheating suggests that there is a much higher current being passed than should be the case; ie, amps and amps. The nominal rating of the neon transformers may be only 250VA (ie, 10kV x 25mA) but are you running several of these on each channel?

We wonder if your application might be better served by the Four Channel Lighting Desk featured in the June & July 1991 issues. This featured 40A Triacs and much bigger interference suppression inductors. It too would require the addition of snubber networks but you would have more room to do it.

MARKET CENTRE

Cash in your surplus gear. Advertise it here in Silicon Chip.

CLASSIFIED ADVERTISING RATES

Advertising rates for this page: Classified ads: $10.00 for up to 12 words plus 50 cents for each additional word. Display ads (casual rate): $25 per column centimetre (Max. 10cm). Closing date: five weeks prior to month of sale.

To run your classified ad, print it clearly in the space below or on a separate sheet of paper, fill out the form & send it with your cheque or credit card details to: Silicon Chip Classifieds, PO Box 139, Collaroy, NSW 2097. Or fax the details to (02) 979 6503.

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

Enclosed is my cheque/money order for $_____ or please debit my

❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | | |

Signature_____ Card expiry date_____/_____

Name _____

Street _____

Suburb/town _____ Postcode_____

FOR SALE

INVERTERS 12V-230VAC 90% EFFICIENCY. Modified Sine Wave. Compact 55 x 160 x 98mm. Light 800gm. Standby 50mA/0.6W. 100 Watt Continuous $99. 200 Watt $149. A.S.S. (09) 349 9413, fax (09) 344 5905.

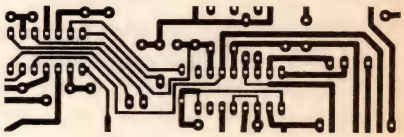
INFRA-RED CORDLESS RECHARGEABLE STEREO HEADPHONES. 20Hz-20kHz. Lightweight. $69. A.S.S. (09) 349 9413, fax (09) 344 5905.

TINY 2/3 MATCHBOX SIZE VIDEO CAMERA MODULES $169. RF MODULATOR $30. Patch these into your TV Antenna System Display and/or Record on all TVs & VCRs. VERY FLEXIBLE & PRACTICAL VIDEO SURVEILLANCE PACKAGE only **$199**. Camera 400+ TVL, 35 x 35 x 25mm incl Lens, Auto Iris, Infra-Red & Low Light Sensitive. IR LEDs 50mW pkt/30 $15 SEE IN TOTAL DARKNESS. A.S.S. (09) 349 9413, fax (09) 344 5905.

D.I.Y. PACKAGED CCTV SYSTEMS. $699. 10" Monitor 4 Ch Switcher, Camera, 20M Cable & Stand PLUG-IN & GO! Features Two-Way Intercom, Alarm I/Ps, VCR I/O, 400 TVL 0.2 Lux Low Light & IR Sensitive Camera. A.S.S. (09) 349 9413, fax (09) 344 5905.

CLOSED CIRCUIT VIDEO EQUIPMENT. Mono & Colour Cameras incl. Lens from $249. 32 x 32 x 15mm CON-

RCS RADIO PTY LTD



RCS Radio Pty Ltd is the only company that manufactures and sells every PC board and front panel published in SILICON CHIP, ETI and EA.

RCS Radio Pty Ltd,
651 Forest Rd, Bexley 2207.
Phone (02) 587 3491

CEALED PINHOLE Modules from $239. 4 & 8 Ch Quad & Freeze Screen Splitters & Switchers from $239. Combination Modulator/Antenna Boosters to Display/Record Video on TV/VCR. Video Microscopes 10X to 1000X. Discounts 10% - 37.5%. A.S.S. (09) 349 9413, fax (09) 344 5905.

PROMO DISK OF SHORT FORM KITS $2 coin. PIC16C5x/71/84 Uni-PCB $20, BasicMicro-1 PCB+Chipset $65, PIC84 Prog/Run PCB $20, PIC84 EEPROM CPU $15, COM1 driven 18 I/O $57, LPT1 driven 64 I/O $35, Z80Dev $35, Z80A+Xt1 $4, Z80B+Xt1 $6, LPT1 Cable $3, 20x2716 $10, PIC16Cxx Prod. Programmer $225. donmck@tbsa.com.au

MicroZed has second source authorised BASIC STAMP alternative. Double and quad speed option available.

EDUCATIONAL ELECTRONIC KITS: easy to build. Good quality. Up-to-date technology. Cheap. Guaranteed to work. Wide range selection. Send $2.00 in stamps for catalogue and price list. Or log onto our BBS FREE for full details of every kit. DIY ELECTRONICS, 22 McGregor Street, Numurkah, Vic 3636. Ph/Fax (058) 62 1915. Ph/BBS (24hr) (058) 62 3303.

ADD AN IBM KEYBOARD DECODER (EA, Dec. 90) to your project. 8 left. PCB, Programmed 8749 & Disk $20. 15 Romloader 256K upgrade PCBs left. PCB, EPROM, 9346 EEPROM, 74HC-4053, Labels & Disk $25. P&P $5. Tantau Australia, PO Box 1232, Lane Cove 2066. AH (02) 878 4715.

68HC705 DEVELOPMENT SYSTEM: Editor, assembler, In Circuit Simulator and Programmer board. Oztechnics, PO Box 38, Illawong, NSW 2234. Phone (02) 541 0310. Fax (02) 541 0734. email:OZTEC@OZEMAIL.COM.AU.

YOUR UNUSUAL PARTS source: UCN5804B, DS1620, DS1202, DS-2401, DS1215, DS1232, UGN3503U, UDN2998W, UDN2993B, MAX038, MAX691, ISD2590, IR LEDs, PCB mounted switches, latest remote control decoder chip & more. With data sheets. DIY Electronics, tel/fax: (058) 62 1915.

486 DX4 100MHz AMD CPU on a VLB motherboard with 256 cache. $475 plus 5% S/H. Prices are in Canadian dollars.

MEMORY * DRIVES * MODEMS

SPECIAL! (Incl Tax)
1Mbx9 – 70ns Simm $65
1Mbx9 – 80ns Simm $58

SIMMS	(Parity/No Parity)	
4MB 30 PIN-70	$212	$212
4MB 72 PIN-70	$221	$201
8MB 72 PIN-70	$477	$416
16MB 72 PIN-70	$868	$750
32MB 72 PIN-70	$1713	$1500
EDO SIMMS		
4MB (1Mbx32)-70ns		$289
8MB (2Mbx32)-70ns		$577
MAC		
8MB P'BOOK		$450
VIDEO MEMORY		
256KX16 70ns (SOJ)		$38
256KX16 70ns (ZIP)		$58

LASER PRINTER MEMORY	
HP 2MB UPGRADE	$160
CO-PROCESSORS	
80387SX/DX to 40MHz	$90
COMPAQ	
8MB CONTURA	$550
TOSHIBA	
2100/50 8MB	$568
DRIVES SEAGATE	
545MB EIDE 14ms 3yr	$269
850MB EIDE 11ms 3yr	$330
1052MB EIDE 12ms 3yr	$372
2150MB SCSI 9ms 5yr	$1270
MODEMS (Includes Sales Tax)	
14,400 BANKSIA 5yr W	$283
14,400 SPIRIT 2yr W	$280
28,800 BANKSIA V.FC	$366
28,800 SPIRIT V.34/V.FC	$460

Authorised VIKING COMPONENTS agents.
America's fastest growing computer memory manufacturer.
EX TAX PRICING AS AT SEPTEMBER '95
Sales Tax 22%, O/Night Delivery $8. Ring For Latest Prices.
Credit Cards Welcome. We Also Buy And Trade-In Memory.

PELHAM Ph: (02) 980 6988 Fax: (02) 980 6991
Suite 6, 2 Hillcrest Rd, Pennant Hills, 2120.

Other items are available. Please write for details. Send Money Orders to Renato Zannese, 615 Roding Street, Downsview, Ontario, Canada M3M 2A6.

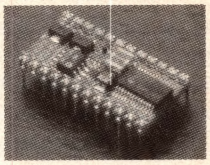
COMPLETE WORKSHOP PROGRAM: suit IBM compatible 386 or better computer. Handles: Stock Control, Customer Records, Debits, Credits, Faults, Manuals and Phone Directory. For demo disk, ring JackAlbers Electronics & Software Development on (045) 71 1640.

SWAPMEET: Glenroy 22 Oct. Sites 25/26. Vintage, amateur components, valves. Catalogue SAE T. Mitchell, 68 Rowan Street, Bendigo 3550.

MICROCRAFT PRESENTS: Dunfield (DDS) products are now available in Australia. Micro C, the affordable "C" compiler for embedded applications. Versions for 8051/52, 8086, 8096, 68HC08, 6809, 68HC11 or 68HC16 $149.95 each + $3 p&h • Now on special is the SDK, a package of ALL the DDS "C" compilers for $410 + $6 p&h (save $139) • EMILY52 is a PC based 8051/52 high speed simulator $69.95 + $3 p&h •DDS demo disks $7 + $3 p&h • VHS VIDEO from the USA (PAL) "CNC X-Y-Z using car alternators" (uses alternators as cheap power stepper motors!) $49.95 + $6 p&h (includes

Basic Stamp 1 & Now 2

HERE AT LAST: Stamp One's **BIG** sibling. 16 I/O plus improved instruction set.



MicroZed Computers
PO Box 634 (296 Cook's Rd), ARMIDALE 2350
V (067) 722 777 F (067) 728 987
Credit cards accepted.

We have other PIC chips with interpreter

'Counterfeit' Dev. Kit 8 I/O
(Scott Edwards' low-cost Stamp compatible)

FBASIC TICkit 21 I/O
(Versa Tech)

Range of accessories stocked. Phone support for all products. Send 2 x 45c postage stamps for information.

SILICON CHIP FLOPPY INDEX WITH FILE VIEWER

Now available: the complete index to all SILICON CHIP articles since the first issue in November 1987. The Floppy Index comes with a handy file viewer that lets you look at the index line by line or page by page for quick browsing, or you can use the search function. All commands are listed on the screen, so you'll always know what to do next.

Notes & Errata also now available: this file lets you quickly check out the Notes & Errata (if any) for all articles published in SILICON CHIP. Not an index but a complete copy of all Notes & Errata text (diagrams not included). The file viewer is included in the price, so that you can quickly locate the item of interest.

The Floppy Index and Notes & Errata files are supplied in ASCII format on a 3.5-inch or 5.25-inch floppy disc to suit PC-compatible computers. Note: the File Viewer requires MSDOS 3.3 or above.

Price $7.00 each + $3 p&p. Send your order to: Silicon Chip Publications, PO Box 139, Collaroy 2097; or phone (02) 9979 5644 & quote your credit card number; or fax the details to (02) 9979 6503. Please specify 3.5-inch or 5.25-inch disc.

Microprocessor For Digital Effects Unit

Now available: the 68HC705-C8P pre-programmed microprocessor IC for the Digital Effects Unit described in the February 1995 issue.

Price: $45 + $6 p+p

Payment by cheque, money order or credit card to: Silicon Chip Publications, PO Box 139, Collaroy, NSW 2097. Phone (02) 9979 5644; Fax (02) 9979 6503.

Microprocessor For Stereo Preamplifier

Available now: the 68HC705-C8P pre-programmed microprocessor for the Remote Controlled Stereo Preamplifier (Sept.-Oct. 1993).

Price: $45 + $6 p+p

Payment by cheque, money order or credit card to: Silicon Chip Publications, PO Box 139, Collaroy, NSW 2097. Phone (02) 9979 5644; Fax (02) 9979 6503.

diagrams) • Device programming EPROMs/PALs etc from $1.50 (inc label). We use and recommend the HILO ALL-07 Universal Programmer • Fixed price PCB layout & photoplots. We use and recommend PROTEL For Windows EDA tools • Credit cards accepted • Call Bob for more details. MICROCRAFT, PO Box 514, Concord, NSW 2137. Phone (02) 744 5440 or Fax (02) 744 9280.

C COMPILERS: Dunfield compilers are now even better value. Everything you need to develop C and ASM software for 68HC08, 6809, 68HC11, 68HC16, 8051/52, 8080/85, 8086 or 8096: $140.00 each. Macro CrossAssemblers for these CPUs + 6800/01/03/05 and 6502: $140 for the set. Debug monitors: $70 for 6 CPUs. All compilers, XASMs and monitors: $400. 8051/52 or 80C320 simulator (fast): $70. Demo disk: FREE. All prices + $5 p&p. GRANTRONICS PTY LTD, PO Box 275, Wentworthville 2145. Ph/Fax (02) 631 1236.

PROGRAMMER/EDITOR SOFTWARE for new Lattice EEPROM 7ns Generic Digital Switch ICs. Just connect to PC parallel port! Use to reconfigure circuits without rewiring! Send SSAE, phone or

Printed Circuit Board Manufacture

Best Prices on Prototypes and Production Quantities.

INSTANT PCB's

P O Box 448 Avalon Beach 2107

Ph (02) 974 1189 Fax (02) 974 5491

poll fax. Advanced R & D Solutions, 12 Copeland Road, Lethbridge Park 2770. Ph/Fax (02) 628 1223.

NEW SPRINKLER CONTROLLER KITS: RAIN BRAIN version uses 'C8 and switch mode supply. Features galore!! Contact **Mantis Micro Products,** 38 Garnet St, Niddrie 3042. Phone/fax (03) 337 1917.

SATELLITE DISHES: international reception of Intelsat, Panamsat, Gorizont, Rimsat. Warehouse Sale – 4.6m Dish & Pole $1499; LNB $50; Feed $75. All accessories available. Videosat, 2/28 Salisbury Rd, Hornsby. Phone (02) 482 3100 8.30-5.00 M-F.

WANTED

SERVICE MANUAL or copy (including schematics) and probes for Gould/ Bidmatton K450 logic analyser. After 7:00pm (03) 872 3360.

SILICON CHIP BINDERS

These binders will protect your copies of SILICON CHIP.

★ Heavy board covers with 2-tone green vinyl covering ★ Each binder holds up to 14 issues ★ SILICON CHIP logo printed in gold-coloured lettering on spine & cover

Price: $A14.95 each (incl. postage in Aust). NZ & PNG orders please add $A5 each for p&p. To order, just fill in & mail the order form in this issue to: Silicon Chip Publications, PO Box 139, Collaroy 2097; Or phone (02) 9979 5644 & quote your credit card details or fax (02) 9979 6503.

Advertising Index

Altronics 28-30

Av-Comm 79

Avico Electronics 85

Car Projects Book ..... IFC

Dick Smith Electronics 12-15

Emona 83

Harbuch Electronics 85

Instant PCBs 96

IRT Electronics 9

Jaycar 45-52

Kalex 43

Macservice 3,81

MicroZed Computers 95

Oatley Electronics 64-65

Pelham 95

Railway Projects Book ..... OBC

RCS Radio 94

Rod Irving Electronics 69-73

R.S.K. Electronics 85

Scan Audio 84

Silicon Chip Back Issues 90-91

Silicon Chip Bookshop 53

Silicon Chip Walchart ..... IBC

Spectrum Management Agency .. 9

Tortech 43

PC Boards

Printed circuit boards for SILICON CHIP projects are made by:

- RCS Radio Pty Ltd, 651 Forest Rd, Bexley, NSW 2207. Phone (02) 587 3491.
- Marday Services, PO Box 19-189, Avondale, Auckland, NZ. Phone (09) 828 5730.

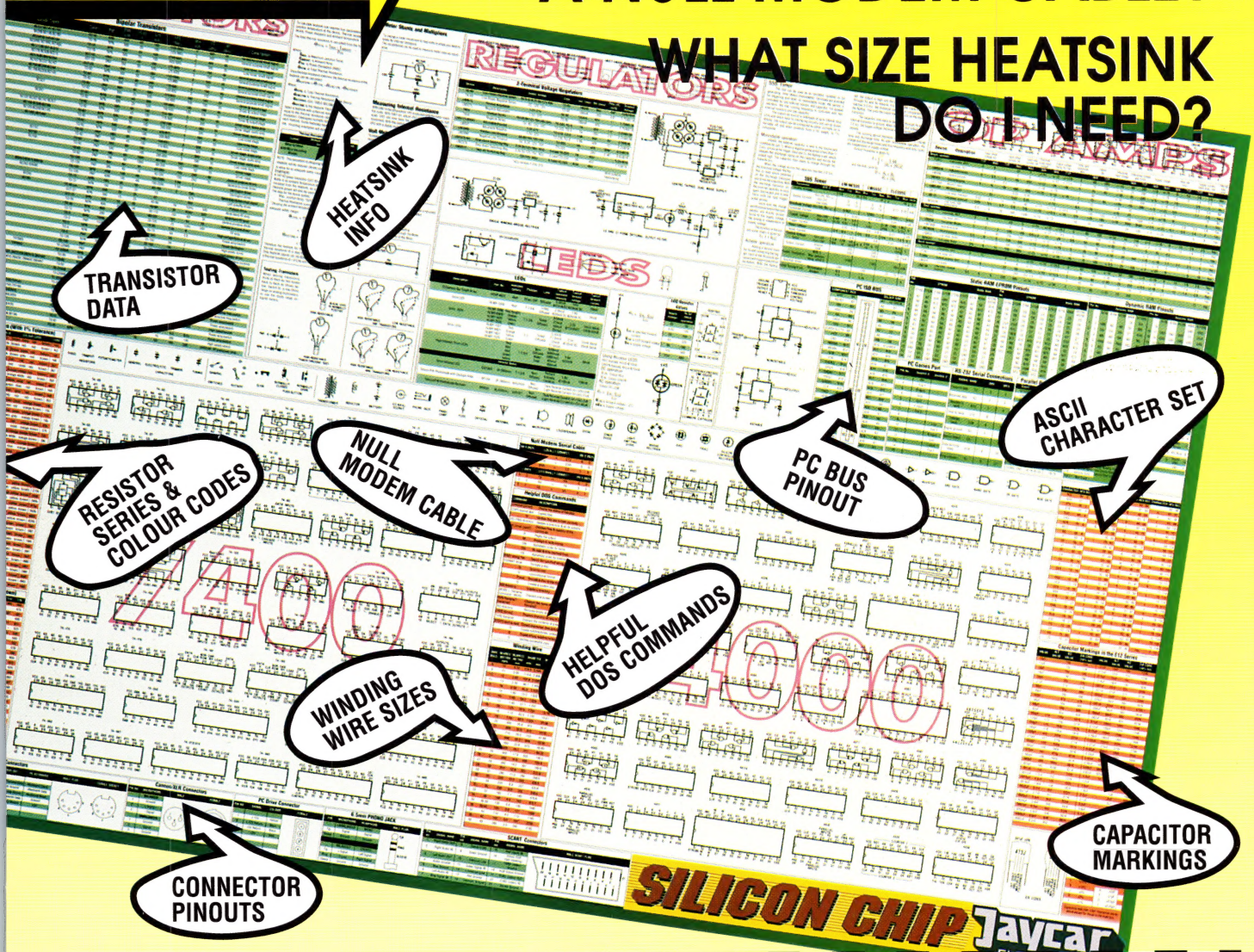
QUICK INFO

WHAT'S THE PINOUT OF A 74H138?

WHICH PIN OF A BC547 IS THE BASE?

HOW DO YOU WIRE UP A NULL MODEM CABLE?

WHAT SIZE HEATSINK DO I NEED?



his giant wallchart (850 x 580mm) has een specially prepared by Silicon Chip Jaycar. Absolutely jam packed with nfo on the most frequently asked uestions by hobbyists, technicians, ervicemen & engineers.

olded: $8.95 + $2 p&p. Unfolded (in ailing tube): $9.95 + $4.50 p&p

Yes! Please send me ____ copies of the Silicon Chip/Jaycar Wallchart. Enclosed is my cheque for $_____ or please debit my: ❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | |

Signature_____ Card expiry date___/___

Name_____ Phone No. (___)_____

Street_____

Suburb/town_____ Postcode_____

Please supply: ❑ Folded ($10.95) ❑ Unfolded ($14.45)

Especially For Model Railway Enthusiasts

Order Direct From SILICON CHIP

Order today by phoning (02) 9979 5644 & quoting your credit card number; or fill in the form below & fax it to (02) 9979 6503; or mail the form to PO Box 139, Collaroy, NSW 2097.

This book has 14 model railway projects for you to build, including pulse power throttle controllers, a level crossing detector with matching lights & sound effects, & diesel sound & steam sound simulators. If you are a model railway enthusiast, then this collection of projects from Silicon Chip is a must.

Price: $7.95 plus $3 p&p

Yes! Please send me _____ copies of **14 Model Railway Projects**

Enclosed is my cheque/money order for $_____ or please debit my

❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | |

Signature_____ Card expiry date____/____

Name _____ Phone No (____)_____
PLEASE PRINT

Street _____

Suburb/town _____ Postcode_____